EW YEAR PREVIEW: WHY DESKTOP PC TECH WILL FLOURISH IN 201

apc

January 2013

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HARDWARE GUIDE

UNLEASH WINDOWS 8

TESTED

HYBRIDS, ALL-IN-ONES AND LAPTOPS THAT MAKE WINDOWS 8 WORK FOR YOU

LABS

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First comparison of 802.11ac routers reveals astonishing speed gains

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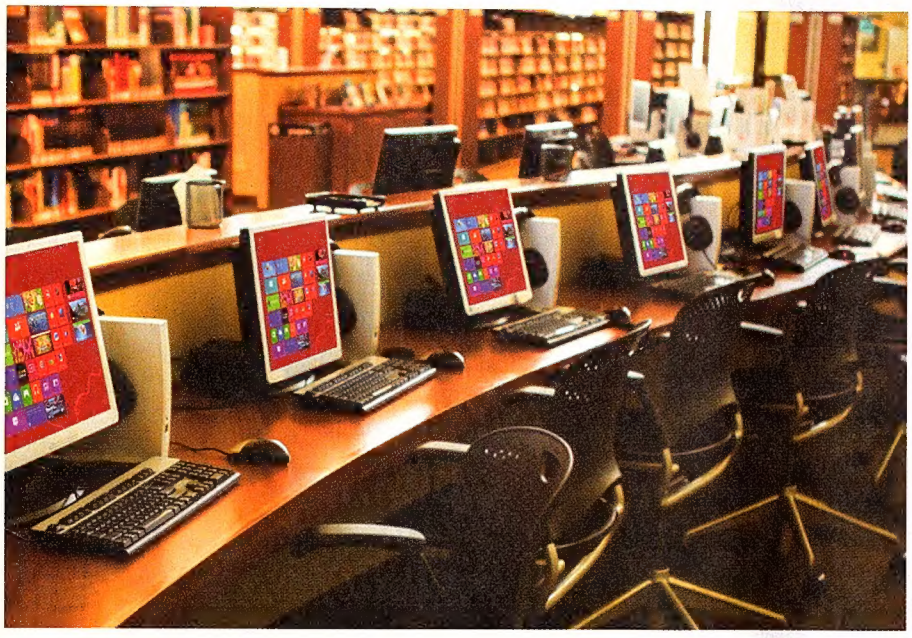
03 editorial

TONY SARNO

But with Windows 8, we've been cautious



The big question we face in the *APC* office is whether we're going to officially switch to Windows 8. Yes, this is yet *another* editorial on Windows 8, but that's because I find this software the most intriguing and polarising OS I have ever dealt with in my 25 years or so covering IT (or since Windows 3.1 launched). The question we're asking is the one many other businesses would also be considering.

Normally, we subscribe to the notion of 'eating the dog food', or using test software in a working environment because we're a computer magazine and need to understand new products well and truly before they go golden master and reach consumers. But with Windows 8, we've been more cautious and only installed it on a few non-production machines.

Why? Because at the moment we're so busy that we can't afford to risk the lost productivity that would ensue as staff retrained for Windows 8's radical new user interface. A magazine doesn't just consist of tech-heads who live to run beta versions of everything, but real people who need to get work done, primarily on the production side. As the editor, I just can't risk us missing deadlines because of slowed output and I'm not just guessing that would be the outcome. I *know* it would be. A trial of Windows 8 on several production staff members a few months ago (**tinyurl.com/d6rbwy3**) gave me a pretty good indication of what would be in store for us if we switched to it.

So, with my editor's hat on, I probably reflect the view of business in general, which will most likely sit back and try and figure out what (if any) compelling reasons exist for switching to Windows 8 from Windows 7, which currently does a fine job and doesn't feel like it's approaching a use-by date of any kind. But as an individual and technology reviewer, I am getting plenty of use from Windows 8 hybrids in the labs – like the rest of the *APC* Labs guys – fascinated by the ballsy innovation in the new OS, as well as its quirks and flaws. Some of the reviewers have even switched to Windows 8 as their main OS and are finding they can live with it.

I think our experience with the new OS sums up the market feeling towards Windows 8. Those who just need to get stuff done and don't care what's under the bonnet aren't going to see compelling advantages in it over Windows 7 because there aren't any. Those who love tech for tech's sake or who have been waiting for decent Windows mobile platforms will be natural adopters of the new OS. The question is, are there enough of them to convince the mainstream consumers?

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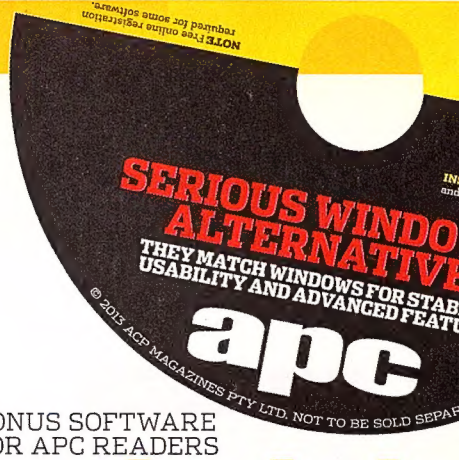
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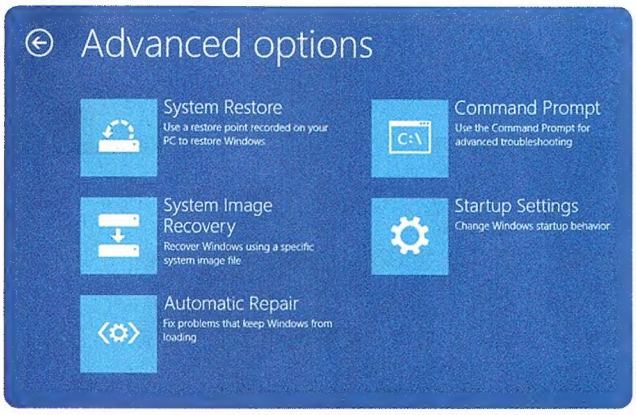
Advanced options
System Restore
Use a restore point recorded on your PC to restore Windows
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Use the Command Prompt for advanced troubleshooting
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Recover Windows using a specific system image file
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Drop no frames, lose no quality.

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SERIOUS WINDOWS 8 ALTERNATIVES

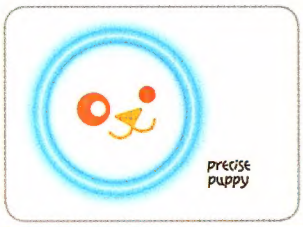
They match Windows for stability, usability and advanced features!

UBUNTU 12.10

Just-released new version of the popular Linux distribution that's now more advanced than Windows in several areas.

LINUX MINT 13

The most Windows-like Linux, making it the easiest OS to switch to.



PUPPY LINUX 5.2

The best Windows alternative for low-powered or old computers bar none.

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ULTRABOOKS

CAN WIN8 SAVE ULTRABOOKS FROM A SALES SLUMP?

With the future of ultrabooks in question, Paul Lilly asks whether Windows 8 will save them.

When Intel and its partners launched ultrabooks in late 2011, Intel's executive vice president, Sean Maloney, boldly predicted that ultrabooks would constitute 40% of the consumer laptop market by the end of 2012, banking on Moore's Law to make his prediction come true.

Well, here we are staring down 2013 and ultrabooks have barely penetrated the struggling PC segment. Not only are ultrabooks viewed as prohibitively expensive, but according to US-based market research firm IHS iSuppli, PC manufacturers have done a poor job of marketing the category. So can the launch of Windows 8 and the release of touch-based ultrabooks save the category?

Craig Stice, a senior principal analyst from IHS iSuppli, believes it will. "I do think touchscreen technology can be a compelling feature for ultrathins and ultrabooks," Stice said. "We live in a touchscreen generation and it's become almost natural instinct for many users – used to their smartphones or tablets – to want to reach out and touch the screen."

Stice also sees the logic in the plethora of hybrids and convertibles being brought to market, which only serve to make the PC more competitive with mobile computing gadgets. However, not everyone we spoke with agreed with Stice's assessment about touch.

"We do not believe that touch will make sense on all form factors," Carolina Milanesi, research VP for Consumer Technologies & Markets at Gartner, explained. "While there is no doubt that touch is here to stay and that it has changed the way consumers interact with content forever... anything that would get you to stretch your arm out does not make sense." Furthermore, Milanesi feels that with or without touch, ultrabook pricing has to come down for consumers to really show interest.

Providing some much needed optimism on the subject, Chaitanya Kumar Ammini, lead analyst with GBI Research (a leading business intelligence provider), expects Windows 8 to have a "significant impact on the sales" of both traditional notebooks and ultrabooks.

"The decrease in notebook shipments in the past two quarters was primarily attributed to customers holding off to purchase products with the latest Windows OS," Ammini stated. "However, GBI Research expects the sales to actually pick up in Q4, which is traditionally considered the best season for electronic goods sales due to the holiday discounts offered."

Ammini isn't worried that touch might add to the cost of ultrabooks, insinuating that it could be offset by helping the category penetrate other market segments, like school children and university students.

Now that Windows 8 is shipping, we'll know soon enough who's right.

TOP 10 WINDOWS 8 ANNOYANCES

01 NO 'START' MENU
Replaced by a tablet-oriented 'Start' screen.

02 NO POP ACCOUNTS
Windows Mail doesn't support POP.

03 TABLET USERSFORCED INTO DESKTOP
For file management, setting screen resolution or user permissions.

04 RIBBON INTERFACE IN DESKTOP WINDOWS EXPLORER
Hated by many in Office, it's now in Windows Explorer.

05 VIDEO DVDs NOT SUPPORTED
Windows 8 plays data DVDs, but not video DVDs. Huh?

06 NO MULTIPLE OPEN WINDOWS IN THE MODERN UI
If you have a big monitor, you're still restricted to one Modern UI window.

07 SWITCHER GROUPS DESKTOP APPS
Each open Modern UI app gets a thumbnail; desktop apps are bunched into one.

08 THE POWER BUTTON IS NOW AN ETERNITY AWAY
Swipe to the Charms bar, click 'Settings > Shut Down'. Groan.

09 NO DESKTOP INSTALLS FOR SECONDARY USERS
Unless the primary user gives you administrative privileges, you can't install desktop software.

10 NO 'BACK' KEY IN SOME MUI APPS
There's no way of navigating to the previous screen of some Modern UI apps.

SSDs

SSDs now growing

With yet another 1TB SSD released, SSD capacity is on the rise.

OCZ's Octane SSD family was the first to include a consumer 1TB SSD late last year, but it wasn't followed by a posse of competitors offering 1TB+ SSD units – just LaCie's Little Big Disk Thunderbolt external SSD, which would set you back $1,299 for what was effectively the world's fastest capacious external drive. Now, another 1TB drive has surfaced, the grandly named Mercury Electra 3G Max 960GB from US-based OWC. To create its first consumer 1TB SSD, OWC had to make a few side steps. The drive is a 3.5in form factor, but inside it's actually two 480GB SSDs in RAID 0. Also, the interface is limited to SATA 3Gbps using a SandForce SF-2181 controller. As you'd expect, it costs a bundle: a smooth US$1,119 compared to US$485 for one of the company's 480GB SSDs.

HARD DRIVES

Hitachi fills its drives with helium

Who would have thought air slows down a drive?

When we think of ways to increase hard drive capacity, we've rarely considered the air inside the hard drive as being a limiting factor. But it is. The air inside creates drag on both the spinning platters as well as the heads hovering over them, lowering performance and requiring more energy to keep everything spinning.

To ease this burden, Hitachi has spent six years researching how to use helium, which is one-seventh the density of regular air, as an alternative. Helium is so thin that it produces less drag and reduces turbulence inside the drive, so the drive's motor doesn't have to work as hard to spin the platters and move the heads.

Since the platters and heads can be moved much more easily, the platters can sit closer together and the data on the platters can be packed tighter, resulting in drives with up to seven platters instead of the current limitation of five. This should translate into a capacity increase of up to 40% in the years to come, with the added benefit of consuming less power as well, since the drive won't have to bust its hump as much.

While the drives won't look much different from today's air-filled drives, they'll be physically stronger since they're hermetically sealed to keep the helium inside. Current hard drives include a breather port, which equalises air pressure inside and outside the drive. Hitachi has stated that the drives will come to market in 2013 – we can hardly wait.

THE (A)PC REVOLUTION
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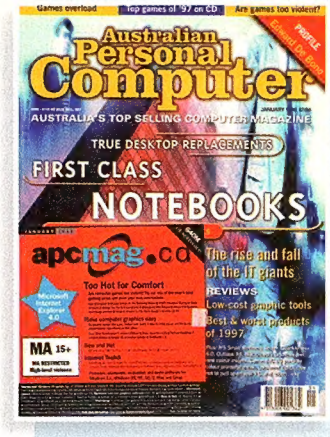

CHANGING FACE OF NET USAGE

According to the Australian Bureau of Statistics's *Household Use of Information Technology* survey, only 7.5% of the estimated four million Australian home-computer users access the internet. The percentage using email is even smaller, at 5%.

PENTIUM BUG

Intel has moved quickly to downplay the impact of a bug on Pentium processors that allows systems to be crashed with just four lines of code. The problem has become known as the 'F0' bug, since the code to begin the crash begins with the hexadecimal code F0.

IBM CLOSES WANGARATTA

IBM has issued an apparent vote of no confidence in local manufacturing with the announcement that it is selling its Wangaratta plant. The plant has been purchased for an undisclosed sum by Blue Gum Technology, a two-dollar company backed by venture capitalists Seventh Wave Ventures, Allen & Buckeridge and ANZ bank. Current staffing levels are expected to be maintained as Blue Gum holds a three-year contract to build IBM machines.

BACKUP

Store data forever

Glass storage is a new way of storing data without it degrading over time. Again, from the Hitachi labs.

Glass storage may have finally solved a problem that has bedevilled all forms of storage – the inability to guarantee that stored data will last forever, or at least a few million years.

Glass storage uses quartz glass squares with a microscopic pattern of dots placed within the glass itself. It can't rub off and is impervious to water and most chemicals, as well as temperatures of 1,000°C. Developers of the technology, Hitachi, say the data should stay readable for hundreds of millions of years.

But how does one write to it? A femtosecond laser pulse is focused at a point within the glass to change the refractive index at that spot. By adjusting the focal plane, you can store several layers of data, one on top of the other.

Hitachi's prototype has four layers, which gives the glass a data density of 40MB/inch. That's about the same as a CD but much lower than a DVD, let alone a hard disk. The data can't be erased again either; it's write-once, like a CD-R.

Because the laser changes the refractive index, you can read the pattern of dots with an ordinary optical microscope. Add a little bit of pattern recognition software and you can read back the grid pattern automatically.

Apart from promising great long-term storage, glass storage doesn't offer any major advantages over existing storage. Glass squares are still quite delicate and don't really offer any rewards for record companies compared to digital distribution.

Where this system will be useful is when archiving data for long periods. Up until now, no one has come up with a medium that lasts longer than good old ink and paper. Hard disks, CDs, flash RAM and tape all need to be rewritten every decade or so to preserve the data properly, but glass squares could be sealed in a vault and forgotten for millennia.

SAMSUNG recommends Windows 8.

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Samsung ATIV smart PC Pro

SAMSUNG

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10 gadgets

Samsung Galaxy Camera

No, this sadly isn't a Samsung-built replacement for the aging Hubble Telescope – the Galaxy Camera is essentially one of the tech giant's smartphones mated to a big-lens 16MP digital camera. The appeal here is really apps and connectivity – it can basically run any Android app on the Play Store, giving you more sophisticated editing capabilities. There's also 3G and Wi-Fi radios, so you can upload shots to the web straight from the camera. Neat.

ONLINE www.samsung.com/au

$599

$499.95

Logitech UE 9000

Let's face it – if you're going to fork out hundreds of dollars on a set of cans to go with your smartphone, they might as well be wireless. Logitech's latest top-end Bluetooth set packs some pants-tightening features like Comply memory foam cups that slowly mould to the shape of your head, a 10-hour battery life and 15m range, USB recharging and a hard carry case. Now you just have to scrape together five of those green notes...

ONLINE www.logitech.com

Libratone Zipp

You have to hand it to Libratone, wrapping a wireless speaker in wool is an original idea (yes, the soundwaves get through unhindered, as strange as it seems). The Zipp is a battery-powered portable speaker wrapped in wool that streams your audio wirelessly via AirPlay *and* is able to create its own AirPlay network, bypassing the need for a Wi-Fi router and letting you take your music on the road. You can connect and stream music to it from any iOS device, Mac or even PC. The only downsides are the price (you pay through the nose for this beauty) and the fact that when it sets up its own AirPlay network, it can interfere with other Wi-Fi networks in the vicinity.

ONLINE www.libratone.com/zipp

$499.95

$549

Dyson DC44 Digital Slim

If you've always wanted a mini, yet ultra-powerful vacuum cleaner for cleaning out various fluff and detritus from your keyboard or the insides of your PC, the new Dyson DC44 Digital Slim is a good option. Basically, this has the sucking power of a full vacuum cleaner, but in a very lightweight (just 2.3kg) portable cordless format. Since it's designed to be stuck in all kinds of nooks and crannies, it's been designed to be evenly balanced when you're carrying it.

ONLINE www.dyson.com.au

HTC Droid DNA

It's official: frikkin' huge smartphones are the new black and it seems everybody's making one. HTC's hoping to steal a slice of Samsung's Galaxy Note success with the new 5in Droid DNA, a behemoth Android phone that packs an eyeball-licking 1080p screen with 440 pixels per inch – higher than any other smartphone or tablet thus far. If you've been putting off that optometrist visit, it could be time to make an appointment... There's no word yet on local availability, but it should start showing up on importers' radars in the next month or two.

ONLINE www.htc.com/au

$TBA

Livescribe Sky Wi-Fi Smartpen

Those who write for *APC* can't live without this gadget. It's not a free plug, but a fact. The Sky is a digital note-taking pen that actually records what's being said. What's really amazing is that when you connect it via USB to your computer and upload the recording, you see a complete replica of the written page on the screen. Put your cursor on any of the handwritten words and you'll hear back what was being said at the time, which makes it a boon for writers, note-takers and students (bear in mind you need a special Livescribe notebook to go with it, though). With this newest version of the pen, the Sky is now able to send the recording to your Evernote account or drop it in your Dropbox or Google Drive accounts.

ONLINE www.livescribe.com/en-au

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$275 (4GB)
$345 (8GB)

FEATURE: APC'S 2013 TECH PREVIEW

THE FUTURE REVEALED

Technology doesn't march along – it sprints like Usain Bolt with a pack of hungry zombies on his tail. Next year will see some fairly big changes to the PC ecosystem. The mainstream tech media will concentrate mostly on what's happening with mobility next year, with an onslaught of new Windows 8 tablets and convertibles on the horizon. Meanwhile, back in the realm where people do actual work, the desktop PC will continue to flourish. We'll see Intel's most important chip release since the original Core 2 Duo and watch as AMD tries to claw its way back with a new FX chip. Next year will also see the graphics war between Nvidia and AMD rage on, SSDs get one step closer to emancipation from the SATA port and possibly 4K monitors that you can actually purchase. No matter what, take a deep breath, drink some water and prepare to jump back on the PC technology treadmill, because it ain't over yet. Not by a long shot.

INTEL'S NEXT TOCK

The chip giant plans to bring the pain to competitors across the board next year.

In the coming months, Intel partisans will get two significant offerings: the biggest change will be the CPU known as Haswell.

It's a 'tock' in Intel's so-called 'tick-tock' design parlance and therefore a more substantial advance in processing. Remember, the bigger leaps, or tocks, are offset from the manufacturing process changes. So, while you might expect the debut of a smaller process to yield a butt-kicking CPU, that's not how the conservative company operates.

Intel instead pioneers a new process with a modestly improved CPU: a tick. Only after the new process version is fully vetted and working with that chip does Intel decide to push performance with a tock. For example, the original ground-breaking Core 2 CPU was built on the same existing and well-tread 65nm process technology Intel had been using for the Pentium 4. When Intel made the switch to 45nm, it debuted with a conservative jump ahead with the Yorkfield and Wolfdale CPUs.

With its 3D 22nm CPUs now well proven in the Ivy Bridge series of Core i chips, Intel is going to swing for the fences with Haswell. Also built on the 22nm process, Haswell features more transistors in increasing parallelism for single-threaded applications and more efficient multi-threaded code. But, don't think Haswell is going to a six-core CPU or an eight-core package like AMD's new Vishera (see opposite for more on that), to say nothing of a 12-threaded jobbie like the Core i7-3960X. For its mainstream CPUs, Intel's guiding principle will be to push performance per core rather than increase core or thread count. So expect Haswell to come in the form of quad-core with Hyper-Threading (HT), quad-core without HT, as well as dual cores with HT on and off.

Lest you doubt that Intel can produce a performance boost worthy of a tock without increasing core or thread count, Intel says it can by extracting more performance out of existing code and making it easier to code for multiple cores. Haswell features deeper buffers, more execution units, improved branch prediction, increased internal L2 bandwidth, and two sets of new instructions intended to increase performance.

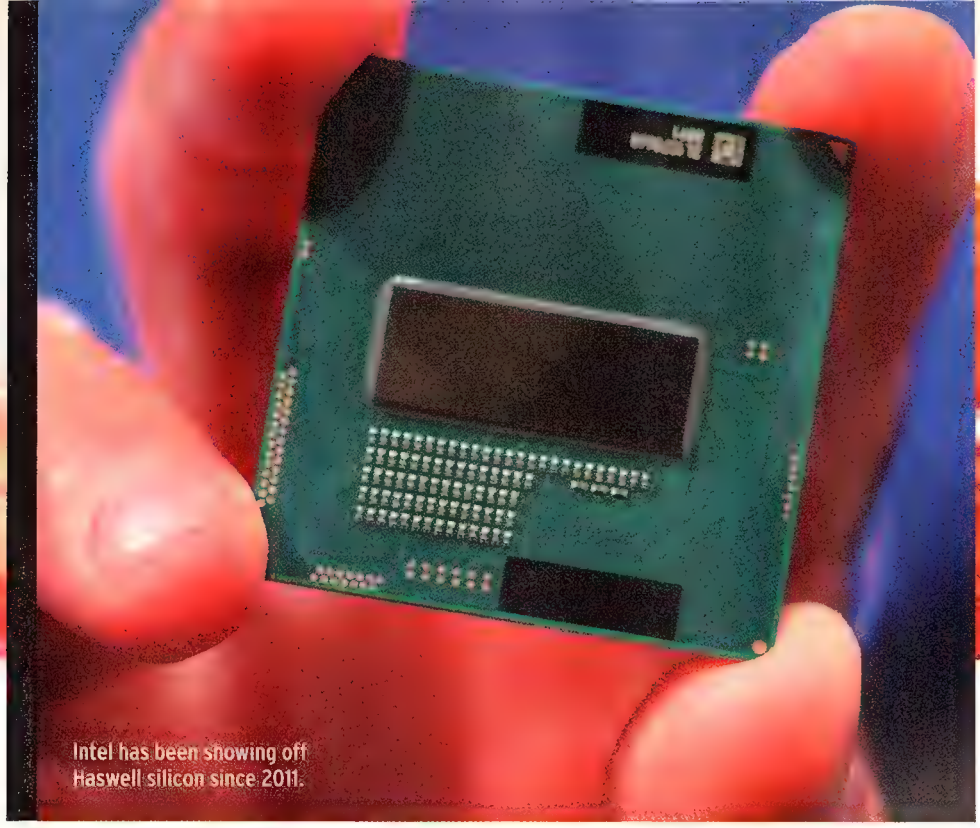
AVX2

Just about every nerd knows that high-performance computing loads can benefit greatly from the GPU's inherent strengths in processing many parallel tasks. Even Intel has finally taken graphics seriously and its integrated graphics have gotten surprisingly powerful for not just gaming, but also compute purposes. But old habits die hard and Intel apparently doesn't want to cede compute performance to the GPU just yet. As evidence, Intel is introducing the new AVX2 instruction set. AVX2 essentially doubles the performance per cycle over AVX in the original Sandy Bridge CPU. AVX2 won't just benefit supercomputer workloads; theoretically, it will greatly increase video encoding and gaming performance.

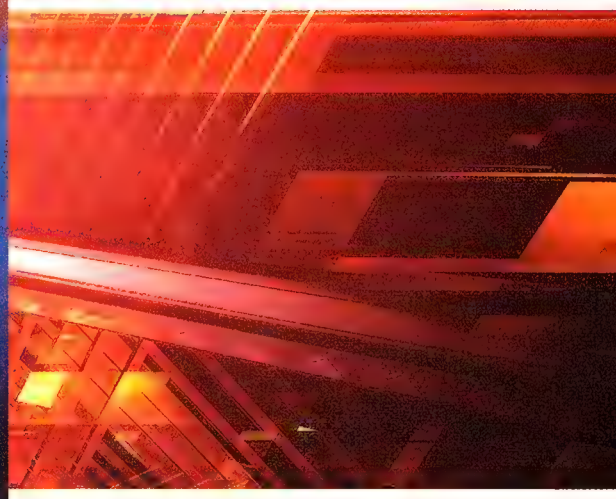
INTEL TSX

The biggest brain-bender feature in Haswell may be the new transactional synchronisation extensions (TSX). TSX is designed to make it far easier to write multi-threaded code.

One example of where TSX is handy is in changing values in a table. Imagine that you and your co-workers are simultaneously editing



Intel has been showing off Haswell silicon since 2011.



THE COMING OF VISHERA

Can AMD make magic?

a spreadsheet. It doesn't take too long to figure out what happens when Ed needs to change how many transmissions are in stock at the same time Harold and John decide to do it, too.

To prevent utter chaos, there are two routes the programmer can take: the easiest is to lock the entire table (or using our example, the entire spreadsheet) so that only one thread, or worker, can edit it at a time. This is called a coarse-grain lock. The problem here is that now Harold, John, Wai and the other four workers sit idle while waiting for Ed to update his information in the spreadsheet. To extract more performance, a programmer can slice and dice the entire table into smaller sections so each can be locked when accessed. This is called a fine-grain lock and it's akin to breaking the spreadsheet into a dozen pieces so more people can edit it at the same time. But a fine-grain lock entails a lot more code for the programmer to write and balance.

What TSX does is add logic, so the processor itself can sense when the same table is being written to by different threads. So if two workers try to write to the same part of the spreadsheet, TSX acts as the traffic cop and either tells one of the workers to chill for a second or sends both to the break room. The programmer only needs to set the rules for how TSX will bounce the workers.

From an efficiency point of view, TSX promises the performance of slicing and dicing that table into pieces with the programming simplicity of locking the entire table.

A NEW SOCKET

Every year, Intel performs the same ritual. It clears the cobwebs off of its test benches, donates the old, ill-fitting lab coats to some disadvantaged company still using a 32nm process and, well, drop kicks the mainstream consumer motherboard socket into the dustbin. Well, guess what? It's that time of year again and LGA1155 is going to join the likes of LGA1156 and LGA1366 in a rat-infested landfill.

As usual, the change isn't being made just to piss you off (at least, we think), but rather to accommodate additional functionality being moved into the processor. LGA1155 is dead, but at least Intel isn't killing the cooler offsets. Like the move from LGA1156 to LGA1155, it looks like LGA1150 will be able to use the same heatsinks as its predecessor.

Beyond core improvements, Intel is also promising huge gains in power conservation. How huge? About a 40% decrease in power consumption while offering more performance. Intel says it will have mobile versions of Haswell that will cut power consumption down to 10W versus the 17W consumed by a comparable Ivy Bridge such as the 3GHz Core i7-3517U.

Overall, Haswell is indeed shaping up to be an epic new processor, but one thing no-one knows is when it will arrive. Intel's only comment at this point is 'sometime next year'.

RED MEAT FOR ENTHUSIASTS

The other big development from Intel will be Ivy Bridge-E. If you bought an LGA2011 board because that's the socket for 'real enthusiasts', you've probably been feeling a little forlorn as of late. After all, LGA2011 is still rolling a CPU with Intel's older 32nm Sandy Bridge cores. Sure, you get six of them, and a boatload of PCIe lanes that LGA1155 can only dream of, but where's the love, Intel?

That love should come, um, sometime next year – the latest word is Q3 2013. Ivy Bridge-E is what you'd expect: six (or maybe eight) cores of 22nm Ivy Bridge action. It was originally predicted for late 2012, so why the delay? Our guess is it's because Intel just doesn't have any competition at the high end. Even the older Sandy Bridge-E will mop the floor with AMD's eight-core chips, so why push it?

The good news is that Ivy Bridge-E should slot right into your LGA2011 board without issue. After that, however, LGA2011 will probably be shuffled off to make room for a new chip and socket.

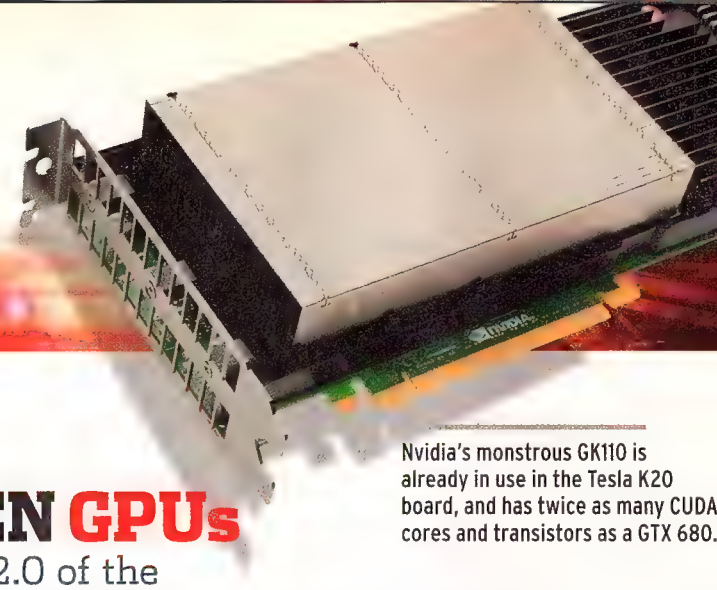
On paper, AMD's Bulldozer microarchitecture always sounded like a mean, green machine. But when it landed last year, in the form of the Zambezi processor (the FX-8150), it actually went about as fast as a real-life bulldozer.

AMD didn't just give up and curl into a ball, though. The company went back to work polishing the chip into the new AMD FX-8350 Vishera. The chip might look like a Zambezi, but it features an improved branch predictor and scheduler, a larger L1 translation lookaside buffer, new FMA3 and F16C instructions, L2 improvements and many other changes.

The best feature of Vishera is its backward compatibility. Vishera should work with most (if not all) AM3+ boards with a BIOS update, and AMD is promising that future CPUs will work with AM3+ as well.

AMD's Vishera looks like the original Zambezi, but features higher clocks and tweaked Piledriver cores.

THE FUTURE REVEALED



Nvidia's monstrous GK110 is already in use in the Tesla K20 board, and has twice as many CUDA cores and transistors as a GTX 680.

NEXT-GEN GPUs

Expect version 2.0 of the same hardware instead of brand-new designs.

ENTER THE TEST BED

To see how Vishera stacks up, we used the same ASUS Crosshair V board that we used to test Bulldozer more than a year ago and outfitted it with a GeForce GTX 580, 8GB of dual-channel DDR3-1600, an OCZ Vertex 3 SSD and Windows 8. Why Windows 8? One issue that cropped up with the original Bulldozer chip was that Windows 7's scheduler didn't know how to deal with the Bulldozer's shared multicores.

For comparison, we dusted off our old FX-8150 and set up a near-identical Intel system using Intel's Core i5-3570K on an ASUS P8Z77-V Premium motherboard with Windows 8. Why the Core i5-3570K? It's the chip AMD uses as a benchmark for the FX-8350 and frankly, it's our recommendation for the sweet spot of computing today.

The result? First, FX-8150 is still slow. It could barely compete with the Core i5-2500K last year and took it on the chin from the Ivy Bridge-based Core i5-3570K in just about every test we ran. In fact, it was so slow in our Premiere Pro CS6 encode that we had to rerun the tests on both the Intel and FX-8150 because we couldn't believe the results.

The FX-8350 fares far better. In fact, we'd dare say the FX-8350 is very competitive with the 3570K in some heavily multi-threaded tasks. For example, take our Premiere Pro CS6 benchmark. The FX-8350 doesn't trounce the i5-3570K, but it cuts the encode time in half over the FX-8150. In other tests, Vishera aces the Ivy Bridge part.

You can't deny the power of the individual Ivy Bridge cores, though. We ran Cinebench 10 on a single core and the Ivy Bridge slaughtered both FX CPUs. In several gaming benchmarks, Intel's more efficient cores also put Ivy Bridge on top, although we did see the FX parts unexpectedly pull ahead in 3DMark, whereas there's usually no difference among CPUs in this test when the same GPU is used. Odd.

What do we recommend? If your chores are mostly limited to gaming and tasks that can't exploit all eight cores, the Intel chip has the advantage. If you're rendering 3D or transcoding or rendering video (except in Adobe Premiere Pro CS6), the new FX-8350 should be your pick. It offers a longer socket roadmap and gives you better performance in these areas. However, we do have to add, that the performance gap probably isn't as good as AMD fans would expect, considering the clock and core count difference between the FX-8350 and Core i5-3570K. Still, for AMD these days, a tie is probably good news considering it's up against Intel's best cores to date.

NVIDIA TO UNLEASH KEPLER 2.0

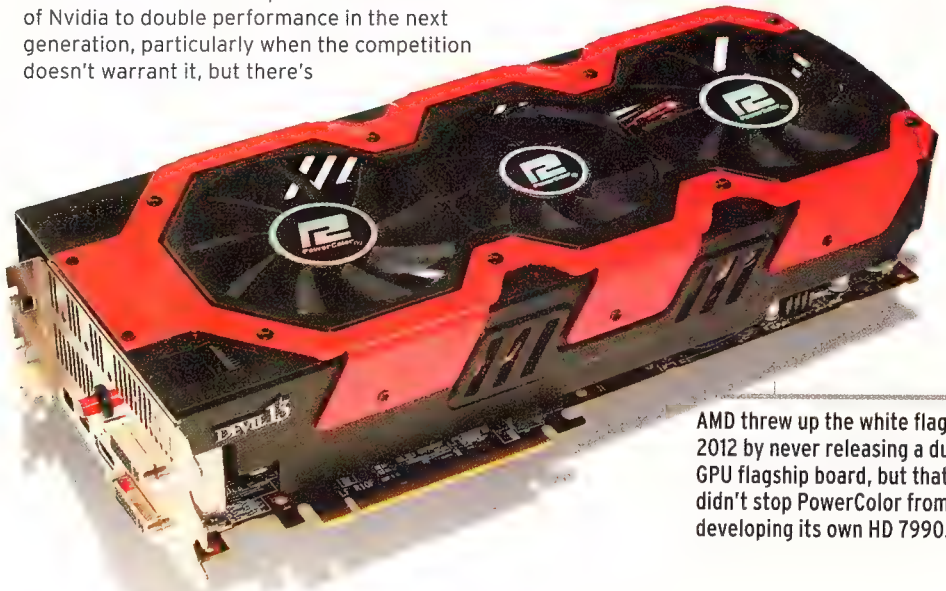
2012 was a great year for Nvidia's Kepler architecture and we'll see second-generation Kepler cards in 2013, though specifics are unknown. Not surprisingly, Nvidia isn't talking. We do know one thing: the GTX 680 isn't the full-powered implementation of Kepler technology, as it features a graphics chip dubbed GK104, which in Nvidia speak means something akin to 'mid-range part'. If you recall, the GTX 560 Fermi board from 2011 featured a chip named GF104, and it wasn't until the GTX 580 was released that we saw a GF110 chip.

So when the GTX 680 launched this year with GK104, we naturally had to ask, 'Where's the GK110?' Nvidia answered that question when it pulled the wraps off its Kepler GK110 chip in May at the GPU Technology conference, revealing a massive GPU that has almost double of everything compared to the GK104 chip found in the GTX 680. Designed for the Tesla K20 that will be used in the world of GPU computing, GK110 boasts twice as many transistors as the GTX 680, sporting 7.1 billion compared to the GK104's 3.5 billion. It also has 2,880 CUDA cores within 15 SMX units compared to the GTX 680's 1,536 CUDA cores in eight SMX units. Its six memory controllers give it a 384-bit memory bus compared to the GK104's 256-bit interface. To be clear: the next-gen GTX 780 won't feature a full-strength GK110 – it would be totally uncharacteristic of Nvidia to double performance in the next generation, particularly when the competition doesn't warrant it, but there's lots of headroom there to offer healthy gains in performance, nonetheless.

With the GTX 680 already holding the title as the fastest single-GPU card for gaming right now, it's possible Nvidia will hold off on overclocking any of its 6-series cards and just move onto its second-generation 7-series Kepler boards. It's an approach similar to Intel's tick-tock strategy – release new architecture and then refine it for the second generation. If you're waiting for all-new hardware from Nvidia in 2013, don't hold your breath. The current plans are to run with Kepler for 2013 until Nvidia's next-generation 20nm hardware, dubbed Maxwell, appears in 2014.

AMD GOES ISLAND HOPPING

AMD had an interesting 2012. It released its all-new Radeon HD 7970 Tahiti board and rightfully claimed the throne of best-performing single-GPU card, only to have its crown stolen two months later by the slightly more powerful yet significantly less power-hungry Kepler-based GTX 680. AMD must have been pissed, and we'd understand why. Regardless, just like Nvidia, AMD will be refining its existing technology for 2013 – the codename of the next gen is Sea Islands (the previous version was Southern Islands). It will be based on a hopped-up version of the existing 28nm architecture named Graphics



AMD threw up the white flag in 2012 by never releasing a dual-GPU flagship board, but that didn't stop PowerColor from developing its own HD 7990.

Card Next, which was first used in the Radeon HD 7970.

Don't be disappointed, though, as we expect substantial improvements from AMD in 2013, especially since the company has seen what it's up against. To wit, according to leaked roadmaps, the next-gen flagship HD 8970, codenamed Tenerife after an island off the coast of Morocco, will reportedly pack a whopping 5.1 billion transistors (a GTX 680 has 3.5 billion and an HD 7970 has 4.3 billion), around 2,300 stream processors, 3GB of memory and a 384-bit memory bus. A dual-GPU version of this card, dubbed HD 8990, is expected to appear as well, but since the dual-GPU HD 7990 never officially launched, it's possible this 10 billion transistor monster will never see the light of day. (It should be noted that a dual-Tahiti HD 7990 does exist, though it's as rare as a brown unicorn and costs $1,000. It's a one-off effort by PowerColor, and not an officially sanctioned board from AMD, with 6GB of RAM, three fans and a TDP over 500W.)

Even more interesting is the rumoured HD 8870, which will offer the HD 7970's level of performance at a significantly lower TDP of just 160W (TDP of the HD 7970 is 250W). When we spoke to the company about its plans, all it would say was that it thinks power-per-watt is an increasingly important feature, that it loves dual-GPU designs and that in the near future we might see a GPU being used for motion-tracking duties similar to those found on the Xbox Kinect and Wii consoles.

STORAGE

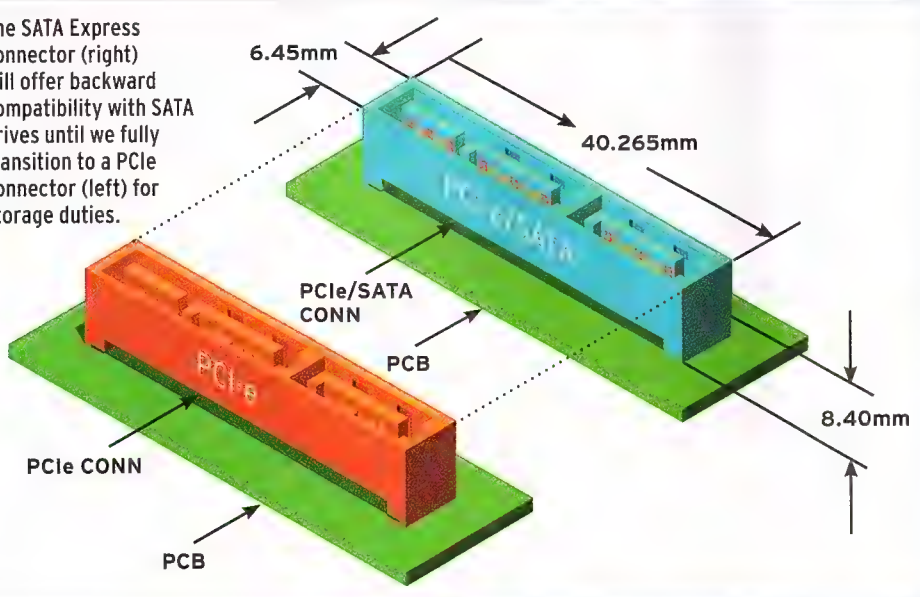
New portable form factor, new desktop I/O.

Bad news, desktop-SSD jockeys: in 2013, our 2.5in SSDs will remain largely unchanged and most of the innovation will unfortunately take place in the portable mSATA format because OEMs need a way to stuff SSDs into ultrabooks. In case you missed the memo, with the launch of Windows 8, ultrabooks and tablets are all the rage these days, but mSATA has too many restrictions so it's getting tossed in favour of a new standard for next-generation drives, cleverly named NGFF (Next Generation Form Factor). This new design and interface will allow manufacturers to create tiny SSDs in a variety of sizes and capacities instead of being forced to use the current one-size-fits-all design of mSATA.

On the desktop, we already have drives saturating the SATA 6Gbps bus and plans are afoot to rectify this with a new standard that combines the bandwidth of PCIe with the ubiquity of SATA, named – you guessed it – SATA Express. The new bus will accommodate SATA 6Gbps devices and PCIe drives at the same time, which is unlike the transition we experienced from PATA to SATA, where we saw two independent connectors on a motherboard and drive simultaneously.

The rapid performance increases of SSDs over the past years has rendered the SATA interface insufficient. Mechanical hard drives are just fine with SATA, but the pace of SSD development is moving too fast for SATA to keep up, so it has to go. Out of the gate, SATA Express will use two PCIe 2.0 lanes, allowing up to 1Gbps transfer speeds. As more lanes are added to the bus, we'll eventually see bandwidth increasing all the way up to 16Gbps. Sadly, we don't anticipate this transition to happen quickly, as we've been hearing about SATA Express for more than a year now and we've yet to see so much as a picture of a working prototype. Our best guess is that we'll see it emerge in 2014, with 2013 being a year where manufacturers begin to highlight features other than speed in the current technology, since most of the drives will be able to saturate the bus at 600MB/s. Features such as power consumption, reliability and encryption will be the talking points until the arrival of SATA Express, when manufacturers will then go back to touting sequential read speeds and max IOPS.

Where rotating drives are concerned, it'll be all quiet on the Western front for the most part. Nobody is talking about where these drives are headed and nobody really seems to care, as we're not interested in their performance as much as their capacities now that we have SSD boot drives. And since there are only two hard drive manufacturers now – Western Digital and Seagate – there's not much competition between them from a consumer's point of view. From our perspective, hard drive coverage will be rare, but you'll see us review 5TB drives when they appear sometime next year.



The SATA Express connector (right) will offer backward compatibility with SATA drives until we fully transition to a PCIe connector (left) for storage duties.

THE FUTURE REVEALED

PORTABLE PCs

Ultrabooks, hybrids and tablets, oh my!

Lest you worry that 2013 will be a quiet year for PCs, consider the knock-down, drag-out dust-up that's about to go down between x86 and ARM. Intel's dream of dominating the mobile space as thoroughly as it's dominated traditional PCs rests on the success of a new wave of devices, not to mention Windows 8.

For starters, ultrabooks will undergo a serious evolution, with key changes under the bonnet as well as in design that Intel says will realise the categories' true potential – the true potential being ultrabooks' ability to compete in a serious way with tablets. Next year's ultrabooks will virtually all sport touchscreens, the natural complement to Microsoft's new touch-optimised OS. Consumers will be able to tap, scroll and pinch their way around the Modern UI, then transition to keyboard and mouse in Windows' desktop environment.

Battery life will be greatly improved, thanks to key power management features in Intel's upcoming Haswell chip. It's been reported to dramatically lower idle power, while a new power state (S0ix) assumes an active state that consumes minimal power, but transitions to active state more rapidly than 'Hibernate'.

Expect to see Smart Connect Technology touted for its ability to automatically update applications such as email and social networks, even when your computer is asleep, and Intel Wireless Display for sharing content from your portable device with your HDTV, as well as anti-theft and identity-protection features. All of the above is meant to help ultrabooks achieve the 'must-have' status enjoyed by Apple's phenomenally successful iPad.

A new subset of ultrabooks that you'll see a lot of next year is the hybrid (or convertible) form factor. So while conventional ultrabooks are slated to become even thinner and lighter – thanks to the improved power efficiency of Haswell along with newer, more lightweight materials – it's the dual-purpose laptop/tablets that will likely really turn heads. Unlike the traditional clamshell body, the hybrid devices either contort into a tablet when the screen is folded all the way back or feature a screen (behind which all the brains of the computer are housed) that detaches from the keyboard for more tablety usage. Even within these two body types, consumers will see a lot of differing implementations and degrees of success as vendors try out new designs to see what sticks.

While the hybrid solution gets closer to meeting tablet ideals (while offering a hell of a lot more power and flexibility in the process, we might add), the x86 takeover of the mobile space might have its best chance in straight-up Atom-based tablets. Yes, Atom is back. But it's not the underpowered lemon of a CPU that fuelled the netbook craze. The new Atom Z2760, aka Clover Trail, is a fully-fledged system-on-chip featuring a 1.8GHz dual-core CPU with Hyper-Threading and PowerVR SGX 545 graphics. We recently spent hands-on time with a Clover Trail-based Acer Iconia W510 tablet running Windows 8 Pro and were surprised and delighted at how much smoother and faster it was over the Atom netbook experience.

Of course, low power consumption is a key in Clover Trail, and Intel says devices using the chip will run for 10 hours on a charge and last up to three weeks on standby. Pricing for Clover Trail tablets also seems promising. Acer has already announced that its 10in W510 tablet will be $799. It's not too much more than Microsoft is asking for its 10in ARM-based Surface RT. And that tablet is limited to the Modern UI and apps sold through the Windows 8 store.

DESKTOP MONITORS

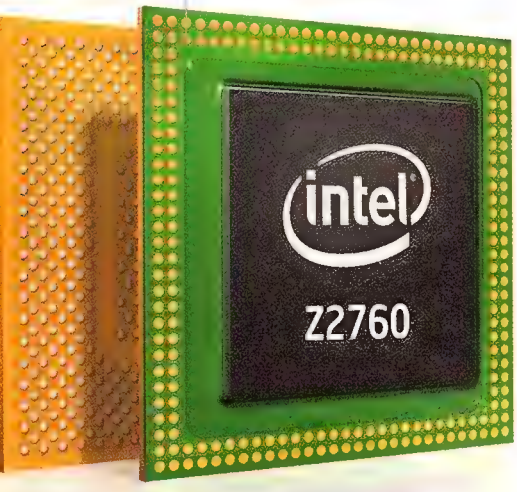
Pixels galore.

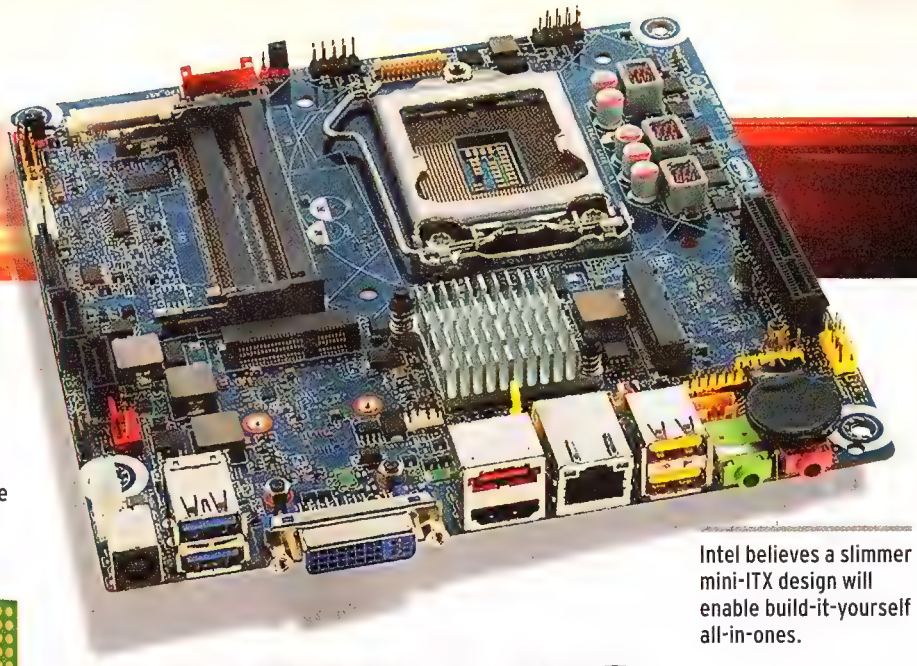
Let's face it: high-resolution panels have been stuck in the mud for years. It's been, what, five years since 30in, 2,560 x 1,600 panels hit our desktops and nothing has advanced. The only real change in monitor land has been a decrease in resolution to 2,560 x 1,440 with 27in panels and excitement over buying reject 27 and 30in screens from Korea. That's all expected to change next year – at least, for those with deep pockets. In 2013, expect to see 4K panels with resolutions of 4,096 x 2,160 hit the streets. A monitor such as Eizo's 36.4in DuraVision FDH3601 (left) is the equivalent of putting four 1080p 23in panels together – for only $35,000. Eizo won't be the only 4K panel maker, though. ViewSonic has been showing off its VP3280, which boasts 3,840 x 2,160 on a 32in panel. Resolutions are expected to continue to climb, too, with Intel forecasting that desktop monitors will hit 4,800 x 2,700 by 2015. By then, the company thinks, a 2,560 x 1,600 17-21in monitor will be mainstream.

Eizo's $35,000 DuraVision FDH3601 is a 36.4in 4K display.

Hybrid or convertible, devices like Lenovo's IdeaPad Yoga will give consumers the best of both worlds: laptop and tablet.

Intel opens a can of x86 whoop ass on ARM with its low-power Clover Trail chip, capable of running Windows 8 on tablets.





Intel believes a slimmer mini-ITX design will enable build-it-yourself all-in-ones.

MOTHERBOARDS

Thin will be in.

Next year, motherboards should continue to offer the same performance and mainstream partitions that we've seen from both Intel and AMD. Intel will continue to support its LGA2011 socket for enthusiasts through at least 2014 and AMD will do the same for AM3+. However, the mainstream will see some changes. Intel will move away from the existing LGA1155 socket in favour of a new LGA1150 socket that's – wait for it – incompatible with existing CPUs. LGA1150 will be coupled with Haswell and is rumoured to come with support for up to six USB 3.0 ports (up from four) and six SATA 6Gbps ports (freaking finally!). The Z87 chipset, among others, may also finally ditch support for PCI.

In AMD land, the socket situation is fairly stable. The company has committed to supporting the AM3+ socket through the new FX-8350 Vishera, as well as through its replacement, codenamed Steamroller. In the mainstream arena, AMD threw FM1 users a change-up by using the new FM2 socket for its new Trinity chips. The good news for those with FM1 boards is that new FM2 CPUs, such as the A10-5800K, are backward compatible with the older FM1 boards. You can't install an FM1 CPU in a new FM2 board.

While micro-ATX and ATX will remain mostly the same, we should see far more movement in the Thin Mini-ITX standard that Intel has been pushing for the last 12 months. Thin Mini-ITX is a motherboard form factor built on the existing mini-ITX spec. It's spec'd to support up to a 65W processor and significantly shrinks the I/O shield from the standard 44mm size used in mini-ITX and ATX to 25mm. The rest of the board is also limited to a thin 25mm height through the use of SO-DIMMS laid flat instead of vertical on the motherboard, low-profile thermal solutions and a long-overdue fixed CPU location. The latter allows chassis builders themselves to implement a customised cooling-solution designed specifically for their chassis. Mini-ITX also specs internal digital video connections such as LVDS and eDP.

Thin Mini-ITX is intended mostly to accommodate a DIY all-in-one market that Intel is hoping will sprout next year, but it will also aid the building of smaller small form factor boxes, too.

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THE FUTURE REVEALED

THE SHAPE OF THINGS TO COME

The PC isn't going anywhere, but it will evolve and adapt the way it always has.

By design, the PC is an incredibly difficult technology to attack. Its commodity components and its open architecture – think of it as the opposite of the walled prison environment – give it the ability to pivot and mutate to meet new challenges and needs.

To wit, in the 1990s, the Network Computer idea was floated as a way to push the PC off of corporate desktops. PCs, as we were told, had become too expensive to buy for every drone and too expensive to support. The NC would leverage the power of the network by running diskless with a very thin OS such as Java or the NCOS.

Instead of adopting the NC computer, though, corporations ended up buying more PCs. Just because the PC was a fat client didn't mean it couldn't alternately run as a near-dumb terminal. Such is the beauty of the PC's versatility. And despite the NC's incredibly low performance needs, which should have lowered prices, the PC's commodity components made them cheaper still to run and service.

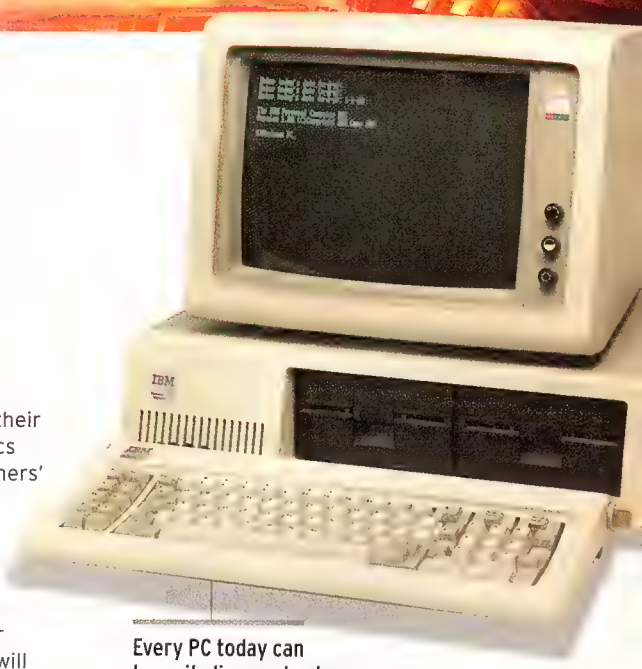
Likewise, the market for supercomputers and workstations wasn't the purview of the PC in the 1990s. Advertisements from competing firms ridiculed a PC workstation as the free toy in a cereal box compared to their specially designed, purpose-built servers and workstations with RISC processors. Today, you'd be lucky to find a non-PC-based workstation, and supercomputers also have largely been dominated by PC technology, via either x86 or PC graphics.

Not all of the threats have been so easy to fight off, though. Game consoles and their fixed (and now ancient) hardware specs have captured casual mainstream gamers' hearts and minds in the living room, relegating PCs to a niche subset of gaming. But that could change.

Meet Valve's Big Picture Mode. Just take an Alienware X51 or Falcon Northwest Tiki, add an Xbox controller and you're playing on a machine that will have any current game console curled up in graphical shame.

The PC's rectangular form factor has also mutated to meet a changing world. Yes, the towers of power will always be with us because some of us actually use said power, although the PC has simultaneously evolved to meet smaller challenges.

Could the runaway popularity of the tiny SoC-based Raspberry Pi become a threat? No way, as the PC is now right there, too. Intel's new 'Next Unit of Computing' is essentially a way for OEMs and hobbyists to build wee PCs. With a Core i3 at its heart, and either dual HDMI ports or an HDMI and a Thunderbolt connector, the NUC is a complete Core i3 box in a 4x4in square. A complete kit with HD4000 graphics, a 40GB mSATA drive and 4GB of RAM is expected to sell for under $400. That's certainly not price-competitive with the $35 bare-bones Raspberry Pi, but it's far more powerful. AMD partners have also been playing in this area, with E-350 and E-450-based boxes such as Zotac's Zbox series.



Every PC today can trace its lineage back to the IBM PC 5150.

Intel's tiny NUC offers full-on desktop power and capability.

We don't even have the space here to get into the phenomenal changes laptops have gone through in the last two years and continue to go through. The fact of the matter is that the PC has evolved to meet every challenge put before it thus far and, in the end, has won. atc

PCs like the Alienware X51 may very well put PC gaming into the living room.

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MICROSOFT OWES ME

Why won't Windows 8 work on my laptop?

I installed Windows 8 when the full version was released on a four-month-old Dell Inspiron 17R Special Edition laptop that initially performed faultlessly. But within two hours it started to go pear-shaped, crashing and freezing. Restarting the laptop wouldn't work as it would just hang and not reboot. A little while after that system restore stopped working. I persisted for a week trying to get it to work, but then decided to reinstall everything, games and all. Within two days same thing started happening again.

My friend installed Windows 8 on two laptops less than eight months old and he is having the same problems, and is contemplating switching back to Windows 7 or even Linux. We are not amateurs at using computer either. My friend and I have nearly 50 years of combined computer experience.

Microsoft should be ashamed for releasing such a piece of garbage. As far as we are concerned, this is the biggest tech fail we have ever seen. Windows Vista and even Me seem perfect by comparison. I figure that with all the time and effort as well as the frustration of trying to get Windows 8 to work, Microsoft owes me at least $2,000 for the wasted effort.

Up until now, I actually was a Windows and Microsoft fan.

Michael Jenner | from the internet

WINDOWS 8 WORKS

I have been reading reviews and comments about Windows 8 in *APC* and *TechLife*, and have a few comments to add:

01 Windows 8 doesn't have a 'Start' button, but if you right-click when you're in the Windows 8 'Start' screen, a toolbar will open at the bottom and show an 'All Apps' button.

02 I don't have a touchscreen, but Windows 8 works very well with just a mouse and keyboard.

03 If you have an application open and want to go back to the 'Start' screen, there's a 'Show Start Screen' button, hidden in the bottom-left corner (hot corner).

04 The only issue I have is with the Mail application. You can't add a POP3 account, only IMAP. Other than that, I think Windows 8 is a great operating system.

Bill Maxwell | Twin Waters, QLD

HAPPY WITH AMD

I read your 'End to end AMD' article (*APC* December 2012, page 72) with interest. One of the reasons I buy AMD processors is because I dread to think what would happen if Intel had the market to itself. Higher prices, less innovation, greater lock-in and so on. Having at least two significant players in the market is essential and something we all should make an effort to support.

I have also been perfectly satisfied with my AMD CPUs. Bang for buck, they are still way out in front. I have just built a new PC based on the A10 Trinity APU and was genuinely surprised at how good it is. I opted not to buy an extra video card and make do with the onboard video, knowing I could easily change my mind later if it wasn't good enough. Based on my experiences so far, that won't be necessary.

B. Schroeder | Warradale SA

RASPBERRY PI

I read Darren Yates's article on the Raspberry Pi and I'd like to add some information about the ARM processor's origin. ARM was originally an acronym for Acorn RISC Machine. Acorn produced the marvellous BBC Model B upon which most school children in Australia, NZ and the UK learned to program in BBC Basic during the 1980s.

The key thing to note is that the ARM chip was designed by the same people who created the desktop operating system (now known as RISC OS) to work on it in the Archimedes and subsequent machines, including the Raspberry Pi Model B.

Acorn was split several ways, including ARM Holdings, Castle (the current OS owner) and Element14, later bought by Broadcom. Fascinating? I wish I had time to write this history.

I am enjoying Wheezy Linux and especially the RISC OS Pi on my Raspberry Pi. My RISC OS Pi is more responsive than most of the Windows machines that clutter my home.

Barrie McElroy | from the internet

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REPLY ALL DISASTER

Our reader sends email to his boss, boss forgets to check email chain.

Reader Paul Morris has written to *APC* to warn other readers of the inherent danger of the 'Forward' and 'Reply All' buttons on Outlook emails (or any other emails for that matter), and to alert everyone to the fact that Microsoft has a plug-in for Outlook that prevents others from forwarding your emails or 'Replying All' to them.

"I nearly had a major disaster with a forwarded email. I am so thankful that was I able to avert a disaster that I felt I should write in and remind other readers to be careful," Paul said.

The near-disaster he's referring to was an email he sent his boss that was severely critical of a staff member's management of a difficult business customer. The conversation went back and forth until both Paul and his boss concluded that the staff member was not at fault, and that a different strategy for handling customers should be followed.

"Pleased with this outcome, my boss then forwarded my original email with his own message at the top, to others on the team involved in managing this customer. Of course, that included the original staff member I was extremely critical of. To my horror, I realised my boss had not deleted the email chain, which began with my slandering of the staff member."

Paul was mortified. And terrified. "It was only a matter of time before the staff member read the email and saw what I'd said about him, and being an excitable kind of guy, and big, I feared he'd storm into my office and punch my head in."

So Paul sat in his office, closely watching the staff member for any clues that he'd read the email and was about to explode. "This really took its toll on me. I expected a drama at any moment. I simply could not concentrate. This went on for a couple of days, and every time the guy said something or moved around I looked for signs he was heading for me."

It was then that Paul had a brainwave. When all staff filed out to attend a project meeting on another floor, he waited until the whole team was gone and rushed over to the staff member's PC, opened his Outlook inbox, found the email and deleted it. He then rushed to the meeting, all before the password screensaver kicked in and locked the PC.

"I know it was wrong, but it avoided a major drama in the office," says Paul.

In theory, Paul should have taken his concerns directly to his staff member before firing off emails criticising the staff member to his boss. But regardless, he was yet another victim of people's regular habit of forwarding emails without checking what's in the email chain below.

What Paul didn't realise is that Microsoft itself thinks that people forwarding emails when they shouldn't, or hitting the 'Reply All' button accidentally, is a major problem. So much so that earlier this year it released a plug-in for Outlook (on Exchange), which prevents the recipients of your email forwarding it or hitting 'Reply All' to it.

This plug-in apparently has been received enthusiastically by several companies around the world who have made it compulsory for staff to use. Their motivation was primarily to stop email storms, ie. someone sends an email to several dozen employees, many of whom then hit 'Reply All', the subject quite often being humorous memes or someone looking for takers for spare concert tickets.

Get it for Outlook 2007, 2010 and 2013 at **tinyurl.com/25q38x2**.

ENDUSER

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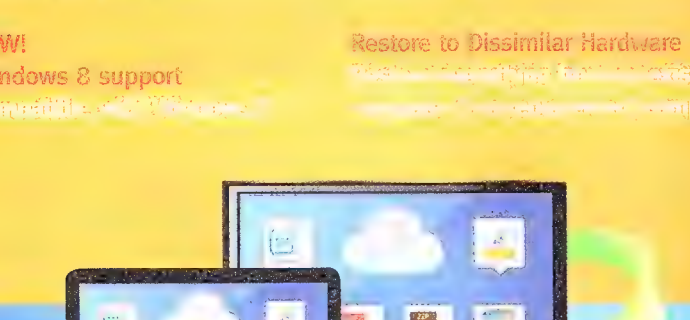

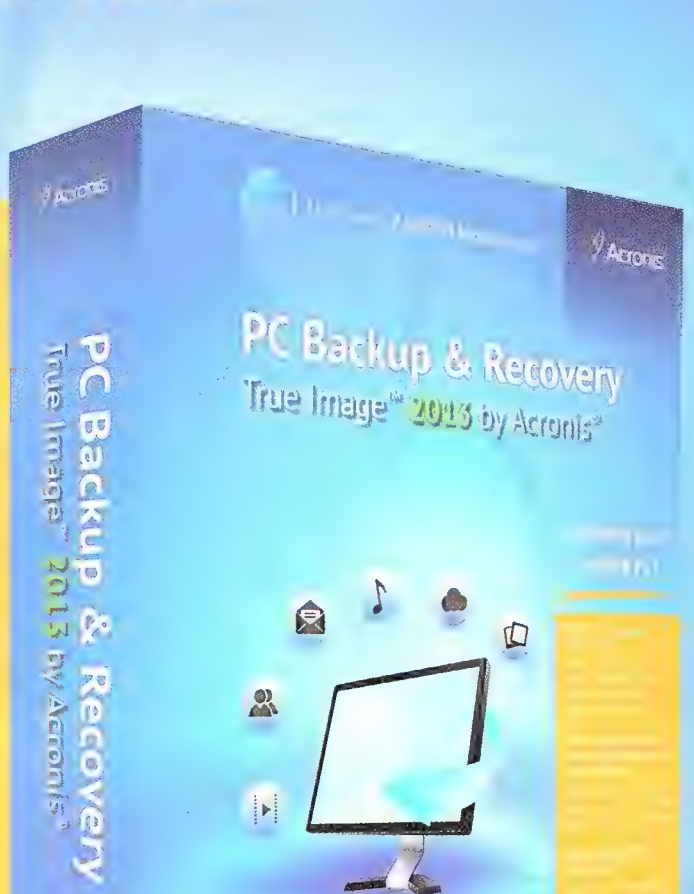

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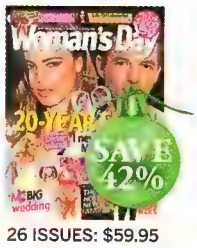

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8/10 Google Nexus 10

Google's real iPad competitor finally arrives.

TABLET

www.google.com.au/nexus @

From $469 (16GB) $

Excellent high-res screen, fastest Android tablet yet, low weight. ✔

Battery life could be better, outperformed by latest iPad. ✖

Android tablets have thus far been fighting an uphill battle against the iPad. While they've made some big inroads in the last six months — largely thanks to Samsung, Amazon and ASUS — Apple's still the dominant player with a near 50% market share worldwide at last count.

So can a flagship Android tablet help? Google's clearly hoping so and it's teamed up with Samsung to produce its first Nexus-branded 10in tablet. Alongside a reasonably attractive (if a little plain) industrial design, the Nexus 10 packs a world-first feature in its 2,560 x 1,600-pixel display, based on Samsung's own PLS tech. That smashes through Apple's iPad Retina record (at 2,048 x 1,536 pixels) — for pixel counters, that gives the Nexus a pixels per inch (ppi) count of 300 compared to the iPad's 263ppi. At that kind of resolution, it's admittedly rather difficult to tell the difference between the two, however. In side-by-side tests, we found both were capable of rendering superbly sharp text and images that are so detailed they're basically indistinguishable. Each has different overall colour casts (the Nexus is a little brighter and vibrant), but they're quite close, especially in terms of contrast performance — details in dark and light images were good across both displays.

Screen aside, the Nexus 10 is quite comfortable and pleasant to use, with a smooth yet grippy back combined with a 600g weight. That means it's easy to use either on the go when holding one-handed, or just on the couch sitting on your lap. It can get a little warm (around 31°C in testing) when intensively web surfing or gaming, but it's not so much that you'll need to put it down.

While the Nexus 10's screen is certainly the lead star, Android 4.2 (confusingly still called Jelly Bean) does offer some useful new features, too. Besides performing generally faster and smoother all round (Google's taken further great strides with this, even since 4.0), the addition of lock screen widgets lets you quickly review things like new emails or calendar appointments without unlocking the device. The Swype-style 'trace to type' keyboard isn't quite as useful here as on the Nexus 4 — there's enough physical space for almost full-size keys — but does ease one-handed text entry.

That said, there are some things that do disappoint. As with Google's other Nexus-branded products, there's no microSD slot and no removable battery. The latter is reasonably forgivable in a tablet where built-in batteries are the general rule, but the microSD shortcoming is a little more of a let-down — the ability to add more storage is one capability that Android can laud over iOS, so it's sad to see it not offered here. The Nexus 10 is fast; it's the fastest Android tablet we've yet tested for both general CPU performance as well as gaming frame rates, almost doubling other Android tablets in the latter category (at 15fps versus 31fps in GLBenchmark's HD test). The downside to that speed seems to be a slight knock on battery life — it managed only 4 hours in gaming, down from the 6 hours of Samsung's own Galaxy Note 10.1. Video streaming fared better, lasting 8:20hr, but that's still a fair bit shy of the iPad 4's 12:31hr in the same test.

And speaking of the iPad 4, its quad-core GPU is still the overall winner when it comes to tablet gaming speed, again reaching around 50% faster than the Nexus 10. If you want the most future-proof tablet for gaming, Apple's is still the better choice.

For Android fans, however, this is a mostly pleasing effort for Google's first 10-incher. If you've been waiting for an iPad-beating Android alternative, this is the closest yet.

Dan Gardiner

EDITOR'S apc CHOICE

9/10

Apple iPad Mini

Entering the Goldilocks zone.

TABLET

www.apple.com/au @

$369 (Wi-Fi 16GB) $

Lightweight, great battery life, solid build quality. ✔

No Retina display, bigger iPad is better for productivity. ✖

The iPad is a tough act to beat. The only competitors to Apple's dominant tablet that have had anything like real success have been Amazon's Kindle Fire and Google's Nexus 7 — tablets that differentiated by being more compact rather than going feature for feature, head to head. Apple now wants to take a slice of that success away by offering up the iPad Mini, but it's a worthy, if not quite overwhelming, contender.

Visually, the iPad Mini looks very much like a shrunken-down iPad, with the exception of the narrower bezel at the sides (when held in portrait orientation). This speaks to Apple's intention that the device should be held from behind, with one hand, rather than with a hand on either side as with a full-sized iPad. And it's a lucky thing the bezel is thinner, as the device is about as wide as we can imagine such a thing being before it's too awkward to hold one-handed. Those with larger hands may differ.

In terms of tech specs, it's almost identical on the inside to last year's iPad 2, including having the same screen resolution. Perhaps paradoxically, the screen looks rather better than that of an iPad 2, partly because the pixels are more densely packed.

Other improvements over the iPad 2 include better Wi-Fi (indeed, we found the Wi-Fi performance better than an iPad 3) and superior cameras front and back. We can't say we find taking photos or video with a tablet — even a smallish tablet — a particularly pleasant experience, however. It feels unnatural compared to something phone-sized or even (heaven forbid) an actual camera. If you must take a photo with a tablet, though, the Mini takes a decent shot.

The iPad Mini will be available with mobile internet capabilities, including support for Australian 4G networks, although that version of the device wasn't available at the time of testing.

Web browsing on the iPad Mini is much more pleasant than on an iPhone, and when using it casually we often found ourselves reaching for the Mini rather than the iPad 3, just because it's so much lighter. If your mobile computing needs run mainly to email and web browsing, the 4G-capable Mini may be a better choice for you than a full-sized iPad.

Our mobile computing needs are generally a tad more stringent than that and *APC* staff often need to use iPads to get work done. To test the ability of the Mini as a productivity tool, this review was written using it. As you can see, it can do the job. However, we wouldn't be looking to trade in our 10in screens just yet. Even in landscape mode, the keyboard is just too small to type with two hands (those with smaller hands may have a little more luck).

Speaking of those with smaller hands, this author's kids (four and seven years old) loved the Mini. It's a good size and weight for them to manage and all of their familiar iPad apps run just as they're meant to.

The other big question with any tablet is battery life, of course, and we can't fault the Mini on that count. I used it extensively for web surfing and for watching videos and playing games, and never found myself looking about for a charger — a handy thing, since the switch to the new Lightning connector means all my old 30-pin chargers are useless. Once the 4G version becomes available, with its support for power-hungry LTE, battery life may be an issue.

The iPad Mini isn't a world-changing device in the way the iPhone or iPad were. Rather, it sticks to the strengths of those devices and offers them in a not-too-big, not-too-little device. If you've been undecided between an iPod Touch or an iPad, the Mini is just right.

Matthew J.C. Powell

8/10 Razer Blade

A laptop designed for gaming.

LAPTOP

au.razerzone.com @

$2,999 $

Some genuinely unique features, good build quality. ✓

Comparatively expensive, not the fastest gaming laptop. ✗

There's little doubt that peripheral maker Razer loves PC gaming. After all, it's built its entire business around it, and it's a company that always seems willing to try new things. That repertoire now, somewhat surprisingly, also extends to gaming laptops, with the Razer Blade being its first product.

As the name implies, this is a sharply designed unit that can be quite capable when it comes to gaming, although the emphasis of this laptop isn't merely raw power, but also the innovation of gaming experience and true portability. With a total weight of 3kg and coming in at 2.2cm thick, it's about half the thickness of most other gaming laptops, but it still uses a beastly black metal chassis and features a 17.3in anti-reflective screen with 1,920 x 1,080 Full HD resolution and a full-size lime green backlit keyboard.

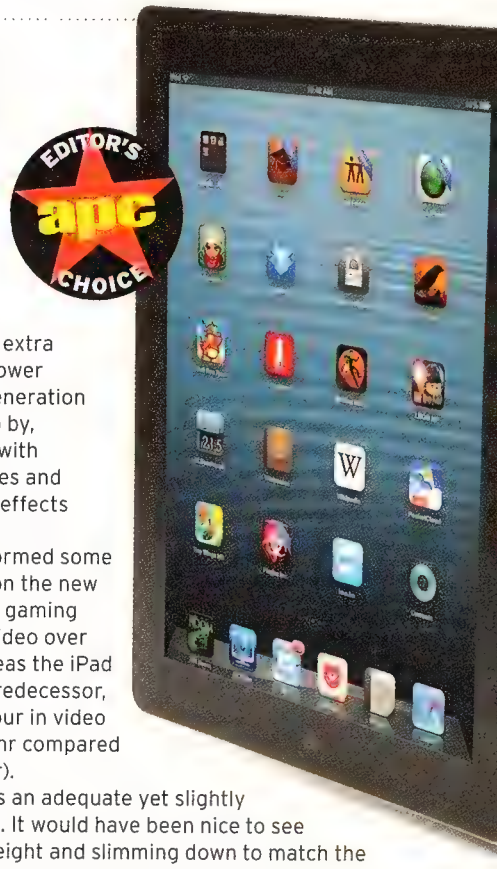
Performance wise, the Blade has the fastest quad-core Intel Core i7 processor (3632QM) you can currently get, which is complemented by a GeForce GTX 660M graphics card. And while it may not be the fastest gaming laptop, there aren't many games out there that you can't play on at least high detail settings. There are exceptions, of course: *Battlefield 3* isn't playable on Ultra settings at 1,920 x 1,080 resolution, for example, scoring barely 18fps on average.

What the Blade lacks in performance, Razer arguably makes up for in its Switchblade system: 10 fully customisable macro keys and a fancy combo LCD screen/trackpad that's a bit like having a smartphone in your notebook. We found the tactile keys to be reasonably useful outside of a gaming environment – it has default buttons to quickly launch email, access Facebook and more, but what's perhaps cooler is that the LCD trackpad can work as a secondary screen for surfing the web or even watching videos. We're not overly impressed with the positioning of the macro keys, though, as they're over on the right, so you'll have to take your hand off your mouse to press them. While the design of the Switchblade is far from perfect, the right-hand position of the trackpad does pay off in one respect: there's no more accidentally touching the pad with your palm!

Daniel Cheng

9/10 Apple iPad (4th gen)

What's under the hood is good.



TABLET

www.apple.com/au @

From $539 $

Fast new CPU and GPU, same price. ✓

A largely performance-based upgrade, no killer new feature. ✗

Don't feel bad if you missed the announcement of the new fourth-gen iPad. Apple and the press have made quite a lot of fanfare about the petite new iPad Mini, but the iPad 4 has largely been ignored. One of the reasons Apple's not made much noise about this new version is presumably because it's relatively frill-free. Most of the big changes are inside and solely there to boost overall performance – there's definitely an element of keeping ahead of the Android competition here.

This is still a solid bit of kit overall, with the usual 2,048 x 1,536-pixel 9.7in IPS display, 653g weight (for the Wi-Fi version), dual-band 802.11n Wi-Fi, and tough and lean physical design. It's virtually impossible to tell the difference between the iPad 3 and 4, save for the change in charging and data port to the new Lightning connector. The latter is still only USB 2.0 in terms of speed however, so you won't see any speed advantages when syncing content from a PC.

The two really significant upgrades are a new CPU and GPU: the Apple A6X and PowerVR SGX 554MP4, respectively. In benchmarks, both those parts are markedly faster than their iPad 3 counterparts – the A6X is over twice as powerful as the A5X in synthetic CPU benchmarks (like Geekbench), and it was certainly lag-free and responsive with every iOS app we threw at it, loading web pages over Wi-Fi in a flash and providing a very smooth and consistent experience. That GPU is likewise super-quick, although there's nothing out there that really takes advantage of its extra 50-95% horsepower yet. If the last generation is anything to go by, we'll see games with upgraded textures and post-processing effects to use it shortly.

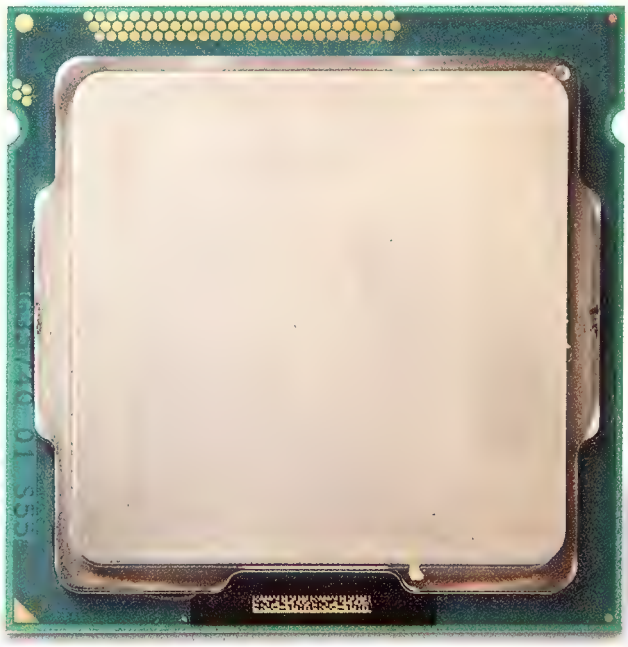
We also performed some battery testing on the new model, including gaming and streaming video over Wi-Fi. In both areas the iPad 4 outpaces its predecessor, by close to an hour in video streaming (12:31hr compared to the 3's 11:40hr).

Overall, this is an adequate yet slightly ho-hum upgrade. It would have been nice to see a reduction in weight and slimming down to match the iPad 2 (at 600g) physically. However, there's enough here to quietly reaffirm the iPad's lead in the tablet race.

Dan Gardiner

6/10 Intel Core i3-3225

Two cores, four threads, no overclocking. Is Intel missing a trick?



PROCESSOR

www.intel.com/au @

$155 $

Not a bad entry-level Ivy Bridge chip. ✔

Competing AMD offerings are better value for money. ✖

The Intel Ivy Bridge technology is the finest desktop CPU tech this side of Haswell, and for the PC build without severe budgetary constraints, it's the architecture we're telling you to stick into your gaming rig. However, what are those of you on a budget missing by dropping down the Ivy Bridge stack to the i3 range, and would we still recommend Intel over AMD at this price point?

The current Core i3 range of CPUs is the real entry point for getting Ivy Bridge. At $115, this Core i3-3225 is at the budget end of the spectrum, though it isn't the cheapest on offer. You can pick up other i3 chips for less than a ton, but then you're dipping below the 3GHz mark and missing out on the top end of the Ivy Bridge HD graphics.

The Core i3-3225 comes with a decent 3.3GHz clock speed and the top HD 4000 graphics. As is the way with Core i3 chips, this is a dual-core CPU, but unlike the Core i5 range, Intel has turned Hyper-Threading back on.

What you don't get is any K-series goodness at this end of the Ivy Bridge table. That means you're stuck at 3.3GHz, so the legendary overclocking prowess of the Intel tech is completely lost on the Core i3 market. That's a massive shame for the eager budget overclockers, but Intel obviously doesn't want anyone getting Core i5 performance out of a Core i3 chip, even if it has to introduce artificial barriers.

In this price range you can take your pick of the competition – AMD has three different options for around the $150 mark and that should give pause for thought for even the most ardent Intel fan. First off, there's AMD's latest budget offering, the Trinity A10-5800K, which is the alternative for anyone who's looking for integrated graphics performance.

The HD 7660D graphics in the Trinity chip outperforms the HD 4000 on the Intel side by a huge margin – we hit 27fps in *Batman: Arkham City* at very high settings at 1080p. The i3-3225 barely managed 16fps. In terms of CPU performance the Intel CPU has the edge, but with a little overclocking of the AMD chip you can close the gap.

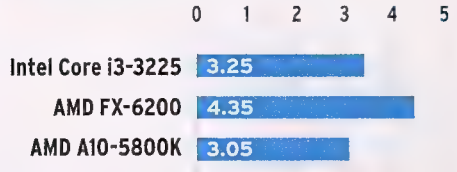
For us, the real competition for this Core i3 chip is the six-core FX-6200. For the exact same price as the i3-3225 you get another two cores for your cash and that makes for much higher multi-threaded performance. Again, the AMD chip can be overclocked where the Intel can't, putting the FX-6200 almost on the same CPU level as a Core i5 at stock speeds.

So, the question I posited earlier regarding our budget-level recommendations is actually an easy one to answer. There are really two options here, but neither of them are Intel-based. If you're not going to let a discrete card anywhere near your PC, then the Trinity chip will deliver almost gaming-capable performance on its own and the FX-6200 will defeat the Core i3-3225 in most tests. It's close at stock speeds, but the Intel chip falls behind when you start to consider the impressive overclocking performance of the AMD chips.

Dave James

CPU RENDERING PERFORMANCE

Cinebench R11.5
Index score: higher is better



CPU ENCODING PERFORMANCE

X264 v4.0
FPS: higher is better

CPU GAMING PERFORMANCE

Batman: Arkham City
FPS: higher is better

HIGHLY apc RECOMMENDED

8/10

AMD FX-8350

Can the Piledriver update make a real difference to AMD's CPUs?

PROCESSOR

www.amd.com/au @

$220 $

Value, better branch prediction, better hardware prefetching and improved scheduling. ✔

Single-threaded and multi-threaded performance haven't improved significantly, Intel chips still preferred for gamers. ✖

When AMD was throwing around the specs of its first Bulldozer chips, we all sat up and took notice. After all, it was AMD's first new CPU technology redesign for an absolute age and what it was planning on doing with the new Bulldozer microarchitecture looked pretty darned revolutionary.

Sadly for AMD, though, its top chip could barely keep pace with the second tier of Intel's Sandy Bridge CPUs. Then it released the 22nm Ivy Bridge die shrink and things got even more miserable for the Texan chip company.

However, as we've seen over the last few months, those AMD Bulldozer chips still have something to offer. Maybe not the top-end eight-core FX-8150, but the great value and overclocking capabilities of the six-core FX-6200 made it a tantalising prospect for anyone on a budget looking to put together a gaming rig.

Value is core to this arrangement, and being able to put together a decent AMD processor/motherboard combo for less than a Core i5 setup means that you get a good chunk of cash to spend on your graphics card. In fact, it's the difference between being able to pick up a Radeon HD 7950 or a HD 7870. And we know which we'd rather have humming away in our machine.

Now, with the Piledriver update to AMD's Bulldozer architecture, we've got the latest FX chips hitting the market under yet another codename: Vishera. Can the revised architecture close the gap on the Intel Ivy Bridge rivals and give its CPU range a performance shot in the arm to match its value credentials?

THREADBARE

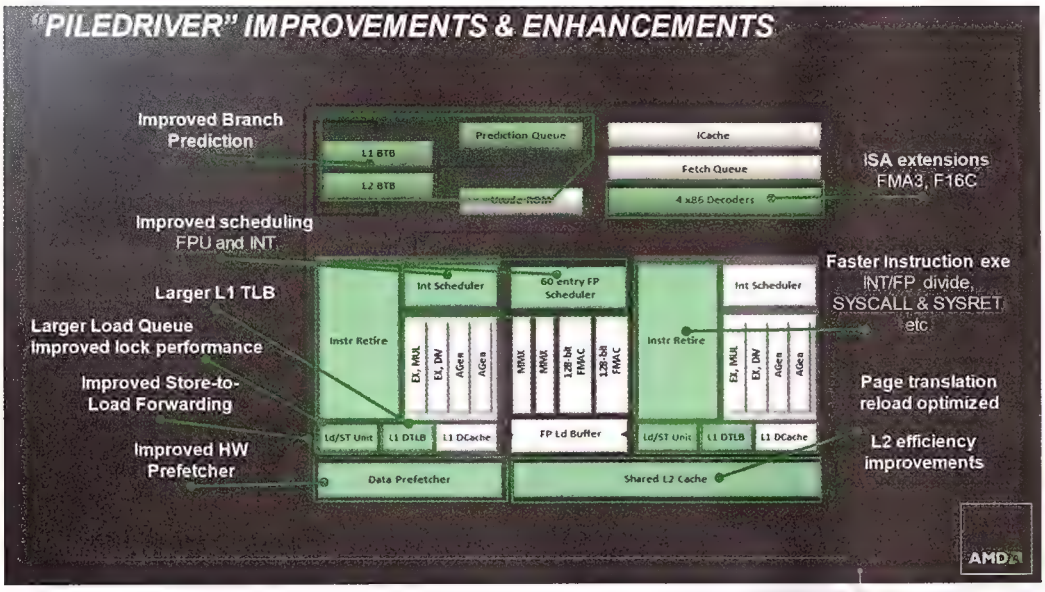
Strap in, we're going to talk about architecture here. The original Bulldozer design was a pretty radical shift in terms of the change from the Stars architecture found in Phenom. It created Bulldozer modules with a pair of cores in each, sharing some lower-utilisation silicon such as Level 2 cache, fetch and decode components, while the more vital, time-sensitive parts, such as the integer pipelines and Level 1 cache, were part of each core.

In actual use, though, this sharing of key components meant that while multi-threaded performance was improved, having so many more threads of processing available meant the single-threaded performance was slower even than the Phenom chips that preceded it. That also meant gaming performance was down the pecking order and the competing Intel chips left AMD trailing in their collective wake.

To try to amend this, AMD has gone and done a little light restructuring of the Bulldozer modules via this Piledriver update. We've seen the first implementation of this new design in the recently released Trinity desktop chips, but this is the first time we've seen it in a dedicated desktop design.

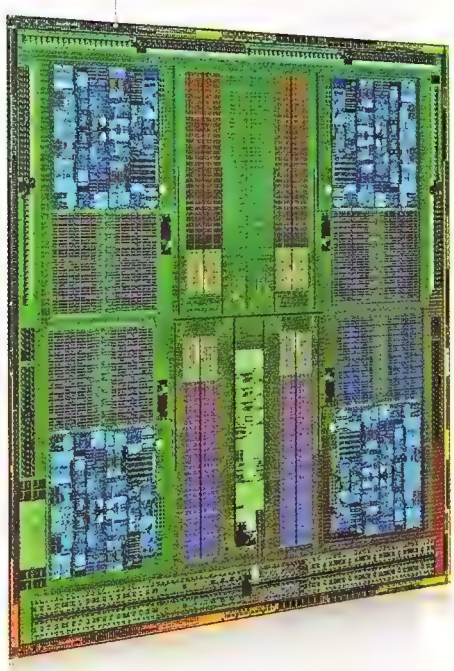
Essentially, this isn't a major overhaul – just a few serious engineer-pleasing improvements such as better branch prediction, better hardware prefetching and improved scheduling. There are some other under-the-bonnet enhancements, but all in all it's relatively low-level stuff.

For the real architectural improvements we're going to have to wait for the arrival of the Steamroller update some time next year. That's set to give the individual cores more dedicated hardware to make them more like the traditional core design. Steamroller doubles up the decode engines in a module and should make for improved single-threaded performance.



The new core improvements.

The pretty new chip layout in all its green glory.



Batman never looked so good.

EXTRA, EXTRA

That's not to say the new Piledriver design doesn't add any extra performance for your cash. In fact, this top-end FX chip is hitting the ground running at 4GHz out of the box. Eight AMD cores running at 4GHz – not too shabby. Sadly, the single-threaded performance hasn't ramped up significantly, so don't get too excited about garnering any extra gaming performance from this new chip.

The multi-threaded performance doesn't see a huge change either – in both segments we're looking at around 15% extra processing speed. On the multi-threading side however, that slight return isn't as much of an issue thanks to the impressive showing of the original architecture.

When you consider that the new FX processors are going to be coming out at around the same sort of price as the Bulldozer chips, that's not a bad slice of extra speed. And with the resolutely quad-core i5-3570K coming in at around $30 more expensive than this eight-thread, quad-module FX-8350, you're going to be getting a substantial chunk more CPU performance straight out of the box.

Throw any multi-threaded application at the two rival processors and the AMD chip will soon show its dominance in that arena. With the Core i5 getting around the same sort of figures in Cinebench as the old FX-8150, the new Piledriver chip is a little over 15% quicker. That performance gap gets even bigger when you chuck the HD encoding benchmark of X264 4.0 at the pair, with the FX-8350 getting almost 25% better results than the Intel Core i5.

In fact, if you take the FX-8350's multi-threaded performance in isolation, it's suddenly getting rather close to the performance of the similarly eight-threaded almighty Core i7-3770K. In Cinebench the AMD chip is only a little over 5% slower, and in X264 there's less than a single percent difference between them.

It's impressive that AMD has managed to close the performance gap this much in the multi-threading stakes. With so many modern productivity programs really taking advantage of the extra threads on offer in today's processors, there would be very little return on the extra $140 you'd spend on the Core i7-3770K versus the FX-8350.

Unfortunately for AMD, we simply can't take the multi-threaded performance of our chips in isolation. Single-threaded prowess still counts for a lot, not least in gaming. And in gaming the Intel CPUs still give a lot more – in our tests we were looking at an extra 10-15%.

Of course, with cash being no object to any of us PC gaming types, we would always go for an Intel CPU to prop up the best graphics card available. However, if you don't have the vast salary of a PC tech journo (cough) then value for money is absolutely vital. The fact remains that an AMD platform is cheaper than an Intel one, and that gives you more money to spend on your GPU. With a better GPU, the gaming performance gains garnered by the Intel CPU architecture become practically irrelevant. Your graphics card is most responsible for your gaming experience, so it makes sense to drop the most cash on that.

UNLEASHED

Like the K series Intel chips, the entire FX range is unlocked, which means overclocking is definitely on the menu. Well, so long as you've got an overclocking-friendly motherboard backing it up. We did struggle a little going through the BIOS of our ASUS ROG board, but with the Windows-based AMD Overdrive software we were able to hit 4.7GHz stably.

We could boot via BIOS overclocking, but once we started stressing the chip it eventually fell over. With the AMD software, though, it remained happily number-crunching away. It's not quite the 1GHz+ speed boost you can get out of Intel's architecture, but it does give you some impressive performance gains.

Running at 4.7GHz, the FX-8350 is significantly faster in multi-threaded applications than even the Core i7-3770K at stock speeds. Of course, the Intel chip can also be overclocked, but it gives you some

idea of how competitive these AMD chips can be.

In a vacuum then, the Intel chips remain the only CPUs you'd want in your machines. They're the best at gaming, and the second-tier quad-core chips remain competitive with AMD's best in multi-threaded applications. However, this Piledriver update has closed the gap a little and in terms of platform value as a whole, the AMD setup just has the edge. Spend the difference in CPU price on a better graphics card and the performance difference in games between AMD and Intel chips will instantly melt away.

Like the Bulldozer release, the top-tier FX chip probably isn't the one that we'd really recommend. The $40 difference in price is negligible and won't make a massive difference in what GPU you go for. The hex-core FX-6300, on the other hand, could be a much more tantalising prospect. If pricing follows the previous generation then you're looking at around a $100 difference, which could make for that bump up to a Radeon HD 7950. The hex-core chip will also overclock happily, so you'll still get decent multi-threaded performance – easily as capable as the Core i5, for a lot less cash. An equivalently priced AMD hex-core machine would then make for a better gaming PC than a Core i5-3570K rig with a weaker GPU.

We need AMD to be competitive to keep the PC market vibrant and keep Intel honest. These new Piledriver chips should be able to do that, especially at the value end of the market. And if that pushes Intel to make better chips – maybe even a mainstream six-core desktop CPU – then that's got to be good for everyone, too.

Dave James

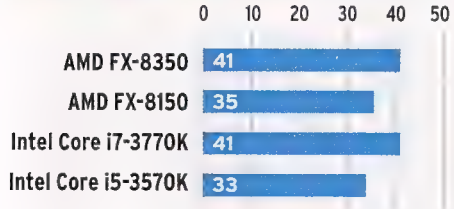
TECHNICAL ANALYSIS

As you can see from the benchmark results, the Core i7-3770K is still the top desktop chip on pretty much all counts, but at $140 more than the latest FX-8350, you're paying through the nose for that extra performance. Compared with the similarly priced Core i5, the FX-8350 looks more impressive, ably beating it in any multi-threaded test you give it. In fact, it's actually rather close to the eight threads of the top Ivy Bridge CPU in those multi-threaded metrics. In gaming terms, though, the Intel chips still retain a healthy lead in raw CPU performance terms.

Intel still rules gaming.

CPU ENCODING PERFORMANCE

X264 4.0: fps (higher is better)

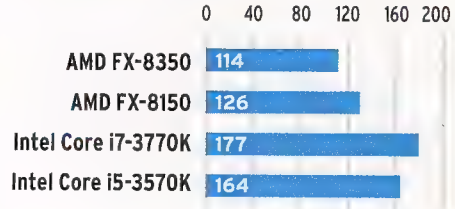


CPU RENDERING PERFORMANCE (MULTI-THREAD)

Cinebench R11.5: Index score (higher is better)

CPU GAMING PERFORMANCE

Batman: Arkham City: Index score (higher is better)

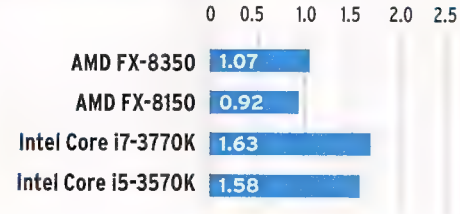


OVERCLOCKING PERFORMANCE

Max OC: GHz (higher is better)

CPU RENDERING PERFORMANCE (SINGLE-THREAD)

Cinebench R11.5: Index score (higher is better)



CPU GAMING PERFORMANCE

Shogun 2 CPU: fps (higher is better)

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iolo

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8/10 AOC i2757Fh

Sexy design, but 1080p only. Is that really a problem?

MONITOR

www.aocmonitor-anz.com @

$360 $

Good price, clear image display, IPS panel tech better than an equivalent TN. ✓

Cheap quality, relatively low 1080p native resolution. ✗

I must confess, I'd normally prefer a higher resolution to go with my larger screen size than the AOC's 1080p, but that's mostly because I've got a graphics card in my rig capable of rendering at stupid resolutions like that. Most modern graphics cards are more than capable of shunting pixels and polygons around at 1080p resolutions, and will come a cropper if you make that step up in resolution.

In light of this, it actually makes sense to have larger screens that still make use of the lower native resolution instead. That way you still get a lot of screen real estate, yet the frame rates don't suffer compared to a 22 to 24in panel. When you're comparing it against those smaller screen sizes, it's pretty impressive that AOC can deliver a 27in IPS panel for just $360. Not long ago this sort of screen would have had to cost well north of $450.

It's also impressive that AOC has managed to create a screen at this price with such a tiny bezel. When I first took the screen out of its box, I actually thought I had my hands on something completely sans bezel; sadly, it's just set flush to the screen and is invisible when the screen's turned off. Still, the black bezel is only 9mm, so it's hardly obtrusive.

So, from a distance at least, the chassis of the i2757Fh looks like a very high-end product. With that panel stretching almost to the limits of the surround and that brushed aluminium base and touch controls, it looks quite luxurious to the eye.

That's all from a distance, however; get up close and you'll soon see the edges of the matte covering for the screen, just begging to be picked at. The aluminium panel at the bottom doesn't feel like it's that securely attached to the rest of the chassis either.

But it's an AOC screen for a little over $350, what did you really expect? It's perfectly functional and as long as you don't get too close, it's rather pretty to look at, too. If you play with the settings a little you'll see beautifully clear, crisp and bright imagery flashing up on your screen.

The IPS panel tech is immediately obvious from the moment it lights up. The colours are much more vibrant than a standard TN screen, though the blacks and whites can be broken with the BrightFrame tech. It's not the best IPS screen, but still better than an equivalent TN.

For such a bargain price, this is a great monitor and you'll be more than pleased with it as it sits on your desk looking all futuristic. If you don't think your rig will manage with higher resolutions than 1080p, then this is a great way of getting a bigger screen without losing gaming pace.

Dave James

6/10 BenQ RL2450H

A monitor for real-time strategy gamers. Yes, really.

MONITOR

www.benq.com.au @

$250 $

Matte screen coating, RTS mode does kind of work, decent price. ✓

Regular viewing modes are underwhelming, very specialised. ✗

How's this for niche appeal? Deeming gamers as a whole too broad a demographic for its latest monitor, BenQ's seeking to court real-time strategy (RTS) enthusiasts with this new entertainment screen, the RL2450H. Developed in consultation with supposedly big-cheese professional *StarCraft* team, StarTale, the marquee features of this very specialised monitor are a dedicated RTS mode and 'black equalisation'. Want that explained in plain English? In the appropriate modes, the RL2450H boosts shadow brightness and tweaks colour balance to reveal extra details in darker in-game areas.

To give the monitor its due, this does work pretty well as a gaming aid, making it somewhat easier to pick up movements in shadowy game maps. However, as you might expect, that doesn't do general image quality any favours. With its gaming tweaks enabled, the RL2450H's artificially bright shadows render movies and other media ugly and flat – which is fair enough – although even when it's toggled back over to regular viewing modes, this screen has some very ordinary blacks, especially for an LED model. That really makes this monitor one for game freaks and game freaks alone.

If that does describe you, at $250 the RL2450 is priced about right for a 1080p TN monitor, with generally good build quality and a lightning-fast 2ms grey-to-grey response time, although we'd point out that even regular gamers may baulk at the very specialised calibration of this screen. Garden-variety amateurs are likely to find this screen too bright for their liking as well.

Dominik Krupinski

8/10 LG IPS 277L

LG's promise of a 1mm screen frame falls through, but it's still an economic purchase.

MONITOR

www.lg.com/au @

$399 $

Factory calibrated, very low-priced for an LED IPS. ✓

Menus are a chore to use, screen frame isn't really 1mm. ✗

Owners of multiple display setups intrigued by the zero-bezel promise of LG's new 27in monitor should prepare for disappointment. Despite a web site and packaging that strongly suggest the IPS 277L boasts a fantastically thin 1mm bezel, the reality is quite different, with at least 1cm of screen framing surrounding the monitor's viewable area.

Assuming you're not put off by that, the IPS 277L is still a great premium monitor. Razor-thin and with a bezel that's still smaller than most competing monitors, this 1080p 27in unit definitely looks the part of a fancy purchase, and the combination of a matte finish, IPS panel and LED backlighting means it walks the walk, too.

Coming factory calibrated to meet exacting colour deviation limits (with a report card to prove it), the IPS 277L renders accurate colours and excellent detail – especially given its relatively low resolution for a 27in screen – making it a great media consumption screen and solid media creation alternative if your budget can't stretch to a 2,560 x 1,440 unit like Dell's U2711. For an IPS screen, it also claims quite a speedy response time (5ms grey to grey), so that makes it a good option for ghost-free gaming. That said, we're glad this monitor does come preconfigured, as navigating its awkward menus is a chore and configuration options are sparse indeed. As is connectivity, for that matter, with a pair of HDMI inputs and a redundant VGA port being the full I/O complement.

Returning to the positives, as you'd expect for an LED monitor, power use is quite low – around 30W at 100% brightness – which, together with a low asking price for such a large IPS screen, make this an economical purchase worthy of that standard ladies' mag tagline: luxe on a budget.

Dominik Krupinski

9/10 BenQ XL2420TX

BenQ's great 3D 24-incher, now with added convenience.

MONITOR

www.benq.com.au @

TBA $

ıtboost, packed with xtras, decent value. ✓

Calibration issues, rtical viewing angle sn't great, expect to get headaches. ✗

We've seen what BenQ's XL2420T is capable of for under $550, and we liked what we saw in three glorious dimensions so much, we forgot about the suicide headaches 3D gives us. It's still a classy 2D performer, boasting great colours, and is about as good as 3D viewing gets on your PC. That's mainly thanks to Lightboost, which improves brightness, and Nvidia's 3D Vision 2 glasses, which tidy up peripheral fuzziness. Now imagine all that with a built-in IR emitter and the 3D specs thrown in – a handsome proposition indeed.

There are plenty of thoughtful extras bundled in. It has a screen control peripheral that attaches via USB and changes the display settings without having to touch the monitor itself. The panel's options also harbour a few game-specific profiles beyond the usual presets. There's an FPS mode, which presumably minimises ghosting, though we didn't notice the difference. Still, by tinkering with some manual settings we're confident you could save a handful of useful profiles.

The 3D experience is pretty special too, and is made even easier by keeping the IR emitter tidied away within the screen's panelling. The wraparound specs, 120Hz refresh rate and Lightboost make for 3D gaming with fantastic depth and clarity. Although the headaches from long-term use don't seem to have been fixed yet, we've come a long way since the early days of 3D Vision.

We noticed some oddities testing the screen in 2D. In busy images, a 'pixel-walking' effect (an odd fuzziness like an out-of-tune TV) appears at the edges, suggesting the clock or phase settings aren't correctly calibrated by default.

Being a TN screen, it doesn't offer a great vertical viewing angle. When we filled it with block colours we found that reds turned to pinks at the lower edge and no amount of fiddling with the doodad next to the stand is gonna fix that.

While this TX model's local pricing hadn't been announced at the time of writing, based on overseas RRPs it's likely to be a fair bit higher than its predecessor. Still, as long as you're not expecting the luxurious build quality of presumably pricier Dell and Samsung screens, this is the way to do 3D.

Phil Iwaniuk

9/10 Google Nexus 4

Could this be the best-value smartphone ever?

SMARTPHONE

www.google.com.au/nexus @

8GB, $349; 16GB, $399 $

Outstanding CPU and GPU, low price. ✓

No 4G, screen only average quality. ✗

The Nexus 4 might just be the best-value smartphone ever made. Packing in some unbelievable hardware for its $350 price tag, this 4.7in speed demon is the latest in Google's officially-endorsed Nexus family of phones, this time around made in partnership with LG (the previous two Nexus phones were manufactured by Samsung).

As with its predecessors, the big draw is that OS updates come directly from Google, meaning you get the latest and greatest faster, and avoid the months-long delays that come with carrier-provided Android phones. And packing the latest Android 4.2, the Nexus 4 delivers a supremely fast and slick user experience, along with a few new handy bells and whistles like lock screen widgets (so you can quickly check emails or fire up the camera without unlocking your phone) and quicker access to certain features and settings, thanks to notification area widgets.

What's most impressive, however, is what's under the bonnet. This is a blazingly fast handset that outpaces even the Samsung Galaxy S III for both CPU and GPU performance. In fact, the latter (a quad-code Adreno 320) is up to twice as fast as that in the S III, managing to double the frame rate in GLBenchmark 2.5.1's HD test (31fps versus 15fps).

That said, sacrifices have been made to get that price down and the primary one is the screen. While it's nice and high res at 1,280 x 768 pixels – meaning text rendering and fine details are quite crisp – the Galaxy S III clearly wins when it comes to contrast and colour. The Nexus 4 looks washed out and flat by comparison. In truth, that's not something you'll likely notice in day-to-day use, and we reckon it's a fair trade-off for the price. Slightly more disappointing is the lack of 4G – reportedly a casualty of not getting carrier network certification – and the radio inside is HSPA+ only.

As with all Nexus devices, the other big caveat is that there's no microSD slot, meaning you're stuck with the onboard storage. We'd be opting for the 16GB version then.

Dan Gardiner

9/10 Nokia Lumia 920

A Windows Phone on steroids, but some unusual growth as well.

COMPONENT

www.nokia.com.au @

$829 (Telstra exclusive) $

Gorgeous design, responsive UI, Nokia's exclusive apps are genuinely good. ✓

Heavy in the hand, WP8 still lags in the app stakes. ✗

The Lumia 920 takes everything that Nokia learned from the Lumia 900 and 800 (and arguably, the ill-fated N9) and super-sizes it. The overall design and engineering is excellent, the 4.5in 1,280 x 760-pixel display is crisp and vibrant, and this is the first chance you'll get to play with Windows Phone 8, Microsoft's updated mobile OS. WP8 isn't the radical reinvention that WP7 was – like the Lumia 920 itself, it's the same thing, only more so. The optically stabilised camera has good low-light performance alongside crisp general photo taking. The underlying dual-core 1.5GHz processor sings along nicely with very little operational lag and Nokia's included suite of apps (covering navigation, music and even *Angry Birds*) make it the pick of the current WP8 crop. But then again, Nokia's bet the entire house on the OS; other OEMs have side bets on the table as well. Those Nokia additions are especially welcome, as Microsoft's been a bit tardy in giving out the SDK for WP8 to developers, meaning the app offering at launch is a little on the meagre side.

The Lumia 920 is LTE/4G capable and that's usually a recipe for rapid battery death, but in our tests it performed well, making it through a day's testing between 3G and 4G zones without issues. Wireless charging is supported, although not included in the box – we've seen it working in person without being able to give it a full rundown.

On the downside, at 185g, the Lumia 920 is undeniably hefty for a 4.5in screen phone – it's heavier than the much larger 5.5in Samsung Galaxy Note II. It's not too heavy to hold, but it's noticeable, and if you generally struggle with larger screen phones this won't help much.

The Lumia 920 is the best argument for switching to WP8 yet, given the extra value additions that Nokia puts in there. Whether it'll be enough to face off against Android and iOS is still a rather open question. What isn't in question is that if you're a Windows Phone fan, this is the handset to buy.

Alex Kidman

7/10 Tritton Pro+

A good 5.1 headset made (slightly) better.

HEADSET

www.trittonaudio.com @

$210 $

Better mic and headset than AX Pro, cross-platform compatibility, clever volume control. ✓

Sound quality sub-standard for pro gamers, convoluted setup procedure, hot and uncomfortable after an hour. ✗

Should you ask anyone at Tritton what the best way to deliver 5.1 surround sound in a headset is, they'd tell you it's by putting four separate drivers in each ear cup – that's 'true' surround sound, after all. It's the ethos behind both the flawed AX Pro headset, and this Pro+.

The Tritton Pro+'s $210 price tag means you're paying a premium for those eight drivers. You're also paying for a more malleable microphone and headset, plus cross-platform compatibility and an interesting volume control that lets you alter the levels of each driver to accommodate for different 5.1 mixes. For example, we found that *FIFA 13*'s crowds sounded like a riptide by default, until we lowered the rear and sub volumes. Sound quality isn't always where you want it to be, but with a little tweaking you can achieve a really impressive surround. We're not sure it's good enough for pro gamers to pinpoint sound cues, though. Ironically, for anything less than pro gaming, the Pro+ is great.

We do have a couple of grumbles around setting the headset up, though. Assembly requires quite a few cables: one proprietary cable from the headset to the Dolby box, one AC power cable, and optical and USB cables connecting to the PC, PS3 or Xbox. It's more simple if you're running an analogue setup to the PC – you just hook up the headset to a PC adapter cable via USB, and plug in four minijacks and a USB into your back panel – but for anything else you're going to have a lot of wires lying around. Isn't there an easier way? The Pro+'s convoluted setup procedure actually makes a great case for wireless headsets.

If we're being harsh, you're not rewarded by anything stellar at the end of the setup. The cans tend to get hot and uncomfortable after an hour, and while the sound they're producing is fantastic with the exception of some muddy low end, when you're sitting there all sweaty-eared looking at five cables going in and out of a box the size of a router, maybe fantastic sound isn't all that. This isn't a headset you'll regret buying or one that fails to deliver on its promises, but neither is it an easy headset to love.

Phil Iwaniuk

7/10 CM Storm Scout 2

Did the Scout need fixing? CM Storm thinks so.

PC CASE

www.cmstorm.com @

$115 $

Accommodates plenty of fans, seven drive expansion slots. ✓

Feels flimsier than the original. ✗

The first CM Storm Scout was a dependable, surprisingly roomy case that didn't take up much space and was still easy on the eye – all for under $100. CM Storm has obviously seen room for improvement, though – hello Scout 2.

Like its forefather, it offers space for giant graphics cards in a relatively small chassis. The Scout 2 feels flimsier than the original, particularly around the power, reset and lighting buttons. There's a slider cover over the front USB and audio inputs, but the plasticky feel doesn't instil the greatest faith in its longevity. Still, credit where it's due: front-mounted USB 3.0 ports are always welcome and with four ports in total (two USB 2.0 and two USB 3.0) you're unlikely to be left holding a flash drive in exasperation. And if the power buttons don't feel sturdy, the top-mounted handle certainly does – another thoughtful addition.

The Scout 2 can accommodate more fans than a Justin Bieber tour schedule. There are nine potential placings, though out of the box it's fitted with just two 120mm units, at the front and rear. There are dust filters at the top and bottom to keep a decent airflow ticking over, but really you'd expect a bit more cooling as standard for this price.

You'll certainly need more if you're planning to make the most of the Scout 2's capacity. There are seven expansion slots to keep your drives in place. The ace up the Scout 2's sleeve is its capacity for graphics cards. We chucked in two of the biggest GPUs we could find (AMD's 7-Series behemoths) in a CrossFire setup and found room to connect the power without too much drama or hand laceration. If your graphics card is huge and fitted with a power connector at the rear rather than the side, it'll be a very tight squeeze. Check the dimensions of your card against the chassis to avoid having to unscrew and remove drive bays. Yeah, you can do that with the Scout 2 now. The top bay, at least.

We do like the Scout 2's new features, yet it seems to be a step back in CM Storm's usual core tenet: build quality. We don't doubt its integrity, but this is an enthusiast-level product and as such it needs to feel luxurious. That's no reason to avoid this case, however: if you want multi-GPU setups and many fans, the Scout 2 remains a strong option.

Phil Iwaniuk

7/10 Cyborg R.A.T. 9 Gaming Mouse

Transformer noises not included.

MOUSE

www.hes.net @

$170 $

Beautifully engineered, highly customisable wireless gaming mouse. ✔

Comfort issues. ✖

It's easy to be intimidated by the R.A.T. 9. It doesn't have the sleek curves and sensual flanks we're used to seeing in gaming mice and definitely falls into the 'function over form' category. But the rugged aluminium base and angular rigidity of the *Transformer*-esque chassis is a comparatively small price to pay, considering its slick engineering and expansive customisation options. Included in the package are three different sized (and textured) pinkie, palm and thumb rests that can be screwed off, swapped, tilted and tweaked to adapt to almost any hand. There's also a hefty weight system (six 5g weights, all magnetic so you don't lose them) if you prefer pushing heavy things around. Strangely, however, when all our tweaking and setting up was done, the R.A.T. 9 still felt awkward and unnatural to wield, especially in the palm and the thumb rest, where comfort compromised button accessibility.

On paper, the guts of the mouse are as theoretically impressive as the chassis. What you get is a quick eight-button mouse with 6,400dpi and 50G acceleration, along with responsive 1,000Hz dynamic polling 6m/s tracking speed. Wireless mice for gaming can be hit and miss in regard to reliable accuracy, but the 2.4GHz (RF over USB) used here boasts a 1ms response and we noticed no latency or imprecision during our review time. Likewise, battery life isn't an issue. There's a pair of lithium ion rechargeables included, and we managed several days of regular gaming before needing to switch them over.

A rugged, customisable and a very capable wireless gaming mouse it may be, but it won't suit everyone, so be sure to get hands on before committing.

Troy Coleman

9/10 CM Storm QuickFire TK

Once you've had clack, you never go back.

KEYBOARD

www.cmstorm.com @

$115 $

A fully-featured small mechanical gaming keyboard with a tiny footprint. ✔

Combined navigation and numeric key banks may be a deal-breaker for some. ✖

Coming in at an insignificant 377mm long, 138mm wide and 33mm off the desk, the QuickFire TK is relatively petite. In fact, it's difficult to see how an extended keyboard is crammed into such a small steel-reinforced chassis without critical compromise. The magic is in how the extended numeric/directional keys are configured. The navigation bank has been absorbed by the numeric keys, with function switching taken care of by the Num Lock key, as it's always done with F-key functions. While it's a clever way to minimise the footprint of the keyboard — and is absolutely genius to this reviewer — it may be a deal-breaker for those (coders) who regularly use both sets simultaneously.

The Cherry mechanical switches come in two flavours: Cherry Red, which are regarded as the gaming-type switch for their smaller strike height, and Cherry Brown, which have a larger strike height and a springier feel. Regardless of which switches you choose, you're guaranteed an almost lag-free clacking experience that, combined with the N-key rollover feature, will register as many simultaneous inputs as you can rage at it. The TK's backplate and lighting scheme is also individually coloured to each switch (red backplate and lighting for Red switches, and brown backplate with white lighting for the Brown) and features a fantastic gaming mode that backlights only the WASD cluster and directional arrows if they're active — perfect for zeroing in on those critical keys in a dark room. Rounding out the board's features are multimedia controls and a Windows key lockout function, as well as a detachable USB cable for easy storage and transport.

Thankfully, the TK's gaming-specific features don't extend into awkwardness, like often-unused macro banks or LCD fluffery. It's a great performer in general, so if you're someone who spends a significant amount of time typing as well as gaming, this one delivers on both fronts.

Troy Coleman

ROXIO

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THE MADNESS OF CROWDFUNDING

Kickstarter looks sets to reinvent the traditional developer/publisher model, but how does it work, exactly? Dan Griliopoulos goes crowdsurfing.

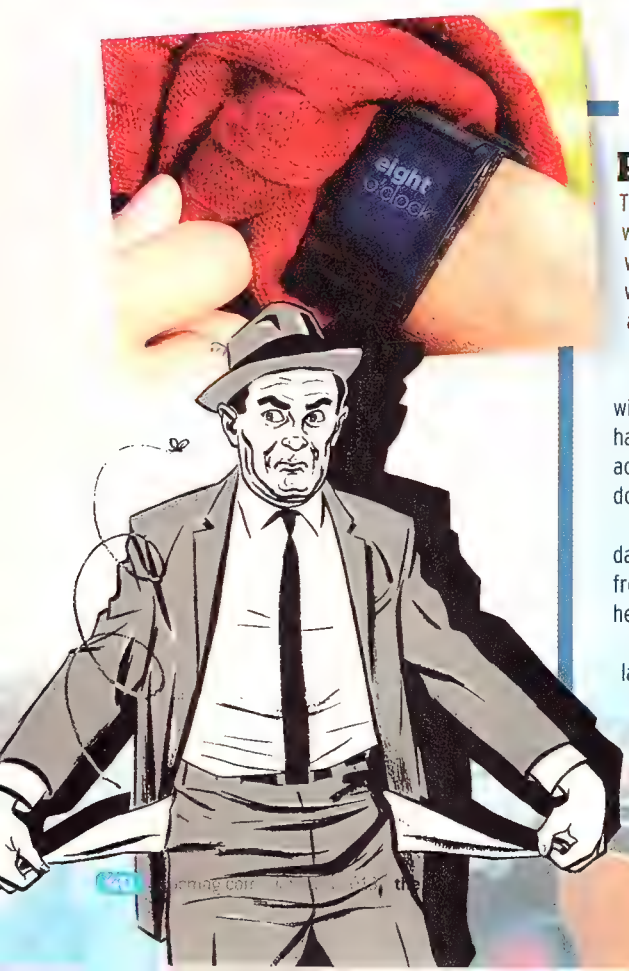
Think of a crowd. Think of a mob. Think of a mass. The collective nouns for 'people' mostly come with negative connotations because, in the English language at least, such large groups are regarded apprehensively. If a third party talks about a crowd's 'mind', then that collective intelligence is automatically levelled down, sometimes to stupidity and more often to madness (except in obscure science fiction or fantasy).

Perhaps this fear of the crowd is a literary hang-up from ancient times, when the mob-fearing bourgeoisie and aristocracy owned the printing presses (say, before 1998), or perhaps large groups of people just tend to behave in scary and antisocial ways. Whatever the reason, we are fundamentally scared of crowds, and the main products of this fear have been theories about coping with them and avoiding them, not benefiting from them.

Yet in recent years, the crowd has been getting more and more attention. It seems that earlier fears of crowds simply played out of our limited understanding of their dynamics. Now we've found ways of utilising the crowd's processing power; now, several technologies, such as Amazon's Mechanical Turk, have allowed companies to 'crowd-source' ideas – outsourcing difficult or lengthy tasks to the crowd, which can complete them more efficiently and cheaply.

And more importantly for us, it started crowdfunding – the use of crowds to pay for and approve projects, often creative ones. The vast majority of crowdfunding platforms are web sites that allow anyone to establish a project, set up a pitch and establish a funding goal, allowing anyone to donate money to their idea, either philanthropically or in return for certain associated rewards. More recently, they've combined social media technology so players can track what their friends are funding and allow projects to go truly viral. In doing so, it may have changed the future of game and technology development forever.

Crowdfunding began in a curious place. There are three notable starting spots. First, there was the 1997 US Marillion tour, which was funded by fans who raised $60,000 without the involvement of the band itself. Second, there was the Nine Inch Nails album *Ghosts I-IV*, which was given away for free, with superfan-targeted versions



PEBBLE

This was the first piece of technology to demonstrate the power of Kickstarter. The problem? Geeks would love to wear watches. Geeks don't wear watches. Sometimes they buy watches, but they don't wear them because they have phones that do much more stuff and they want to have the futuristic watches they saw as kids – Dick Tracy's CB radio watch or Iain Banks's terminals that can tell you anything. A $1,500 watch that can survive total immersion to a depth of 1,000 feet isn't the great leap of our science fiction dreams.

Pebble is that science fiction watch made real. It's a water-resistant device that can communicate with Android and iOS devices using Bluetooth 4.0 and an open SDK. In terms of hardware, the watch has a 1.26in 144 x 168-pixel epaper monochrome display, plus a vibrating motor and a three-axis accelerometer. In terms of software, the watch will come with cycling and golf apps, and more can be downloaded via your phone.

All the high-end watch companies would never make something this risky – something that might damage their brand if it failed. Indeed, the Pebble's creator Eric Migicovsky attempted to raise money from investors the traditional way, but only managed to get $375,000. "I wasn't extremely surprised," he explained. "Hardware is much harder to raise money for."

But Kickstarter showed that the demand for something as cool as this is huge. In April 2012, it launched with a target of $100,000. A month later, funding closed with over $10 million pledged by just 70,000 people. A week before closure the company had stopped taking pre-order donations, as it was worried that it wouldn't be able to fulfil them.

OUYA

There are reasons that many of these projects haven't got funding from investors – they're crazy. Ouya is one of those.

Games consoles have traditionally failed spectacularly (see Gizmondo, digiBLAST and the N-Gage). They haven't sold any units or had any games to play, or have turned out to be tax dodges/money laundering scams. Investors have been burned so often they'd have to be mad to fund them.

But Ouya is different. Yes, it's made by a small company with no history in this field, but it's being built with Android technology and supports the game-streaming client of OnLive, so it already has a huge library of AAA titles. It's got designers on board who have made games consoles before. It's super cheap at only $99. It's designed around downloadable games. It's even got a touchscreen on its control pad!

Ouya made its Kickstarter goal of nearly $1 million in less than eight hours. By the time it closed, it had made $8.5 million. Founder Palmer Luckey said: "Kickstarter really helped provide a high visibility, easy-to-use platform for launching our developer kits. Not just gamers, but a lot of technology enthusiasts as well, browse the Kickstarter site looking for cool projects, and we got a lot of backers that way". With success came more support – Square Enix has pledged to put *Final Fantasy III* on the console, former Infinity Ward developers announced exclusive games for it, and many other media firms have announced they'd be supporting it.

We expect that Ouya will never be a mass-market console – it's too complicated and too ugly to have broad appeal, and it's likely that the next generation of TVs will have similar (cheaper) hardware built in to support streamed and Android games. Most games industry people believe that the days of consoles are drawing to an end anyway, but Ouya could be an upstanding member of that last generation.

carefully tiered by price and exclusivity. Finally, there was ArtistShare, the first dedicated crowdfunding site, which was founded in 2000 to help artists pay for albums. The first completed project on ArtistShare won a Grammy award and its artists have received 13 nominations since.

Like these examples, the vast majority of crowdfunded projects are entertainment. Professor Yan Chen of the University of Michigan School of Information thinks there are two reasons for this. "First, traditional funding sources for arts and humanities have been cut more drastically than other areas, such as science and engineering, in recent years," he says. "Second, the deliverables [final products] are easily evaluated by the laypeople, and thus more suitable for crowdfunding."

Andy Payne, serial games entrepreneur, says: "It's come out of bank lending and investment grinding to a halt and creative people getting tired of talking to people who don't know what they are talking about."

There are now crowdfunding platforms for pretty much every project under the sun. ArtistShare helps musicians find sponsors to let them complete pieces; Fundageek pays for technical innovation and scientific research; Fundable pays for startup businesses; GoFundMe helps people who are recovering from health problems; Indiegogo does indie games; Loudsauce crowdfunds social awareness advertising campaigns; Mobcaster creates TV pilots; Weeve is a non-profit crowdfunding site for non-profit organisations; and **myfreeimplants.com** focuses on funding for breast augmentations. We kid you not.

GETTING KICKSTARTED

The major funding platform at the moment is Kickstarter (**www.kickstarter.com**). Since it launched in April 2009, over 2.5 million people have used it to pledge over $389 million in funding for more than 74,000 creative projects. Of that, $333 million has gone to projects that met their targets and were ultimately successful. The site has a success rate of 44%, skewed down by a few projects that never get any money. Most projects have goals in the $1,000-$10,000 bracket, but 14 projects have broken $1 million (we've listed three in the side boxes within this article).

Why is it so popular? Well, part of it is the snowball effect that made *World of Warcraft* and Facebook the world's leading social game and network, respectively. Another factor is that Kickstarter is an all-or-nothing, no equity funding site. This means that when you set your target for funding – be that $10 or $10,000,000 – you have to raise at least that much or you get nothing. The no equity clause means that those who pledge money via Kickstarter don't get any share of the company, unlike other platforms like Gambitious.

If you help fund a project through Kickstarter, you're not guaranteed any return; if the project fails, you get nothing. What you get if it succeeds is specified by the project creator. He or she can do this by setting up funding tiers of, say, $1, $5, $10 and so on. Once a donor passes a tier, he or she gets the benefits associated with that tier. What Kickstarter doesn't allow is for users to get either a profit or a share of the project they're funding.

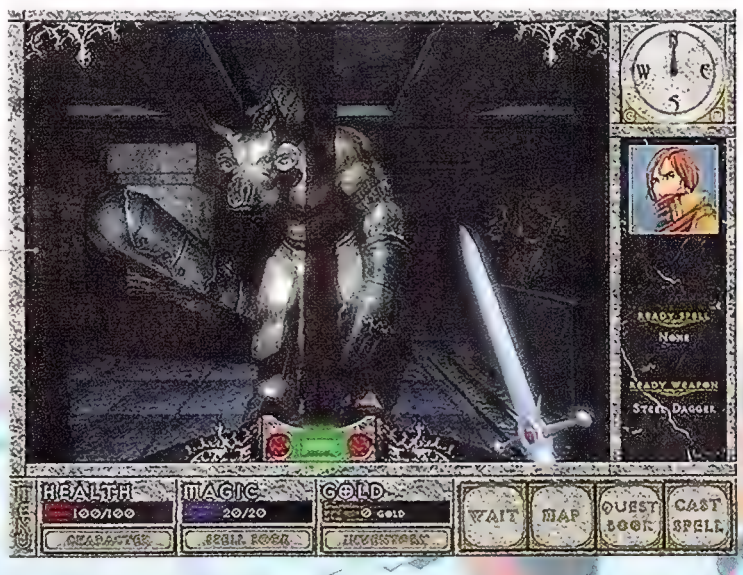
Over the last two years, participation in funding projects has surged so much that we're predicting a hollowing out of major companies as a generation of entrepreneurs decide to go it alone. Andrew Schrage of Money Crashers tells us that "crowdfunding transactions were roughly $1.5 billion in 2011, with some estimates doubling that figure for this year. Some analysts say it could reach $500 billion in 2013."

The biggest success stories of crowdfunding, mainly through Kickstarter, are games and technology. For games, the watershed project was Tim Schafer's *Double Fine Adventure*.

FINE ART

Schafer was behind the legendary adventure games *Monkey Island* and *Grim Fandango*, and Double Fine is his studio. It used to work on projects for major publishers, typically producing AAA games that were too quirky, clever or hardcore to sell particularly well, and it was struggling badly. Each new problem made it spiral closer to bankruptcy and the team seemed doomed.

When its over-hyped *Brütal Legend*, a heavy metal action game starring Jack Black, was



A persistent, infinite *Dungeon Master*-esque world of adventure. *Malevolence* sure looks fun.

canned by Activision and then failed to sell for EA, the sequel was cancelled. Schafer sent his team away and told them to come up with lots of small games that could be sold as download only. These all got publisher support, kept the company going and garnered critical success (and popular adulation). But although they satisfied the team's creative itch, they didn't refill the coffers.

Schafer still wanted to make a new adventure game, but no one would buy it. As his long-time collaborator Ron Gilbert (creator of *Maniac Mansion*) said: "I can tell you that if you even utter the words 'adventure game' in a meeting with a publisher, you can just pack up your spiffy concept art and leave."

So Schafer bypassed the publishers and set up a Kickstarter in March 2012. His pitch to the public was straightforward: you trust me and my company, you know we'll make something great, you can't get good new adventure games any other way, and we only want $300,000. Notably, he mentioned very little about the game itself.

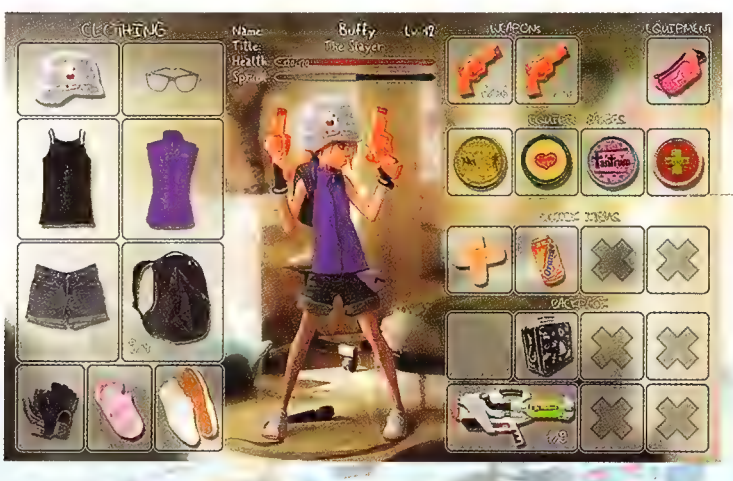
In AAA game development, $300,000 is a tiny amount (the downloadable games had been working with a budget of $2 million each), but public interest was such that Schafer's project blasted past its modest goal, securing $400,000 in the first nine hours alone. By the time payments had closed a month later, the game had raised nearly $3.5 million from 87,000 backers.

This still isn't a huge amount in terms of game development, but it signalled to many other developers that Kickstarter was an alternative funding spot for their games – it completed the breakdown of the publisher/distributor system that had been the bane of developers' lives since the end of Shareware in the 1980s. With Steam Greenlight and Kickstarter, developers can now fund a game by themselves, promote it at the same time and then distribute it (without the fixed cost of manufacturing stock), retaining the majority of the profits for themselves.

THE BALL & CHAIN

"The advent of digital publishing, Steam, the App Store, Google Play and digital downloadable content everywhere is eroding the near monopoly which was traditionally held by the major publishers," says Todd Tribell, co-founder of Digital Capital, a highly specialised investment firm for cutting-edge technology. "As a result of digital downloads, the risk of maintaining $10-20 million worth of inventory one might not sell is now eliminated. Combined, the elimination of the 'ball and chain' as I call them [inventory and console licences] is, in my opinion, the game-changer here."

Since then, we've seen many indie studios redirecting their efforts towards Kickstarter and many better-known developers leaving studios to go it alone. As Tribell says, "We are in a dynamic time in this industry and the shift has already occurred – past tense. This I attribute from a practical perspective to Harrington and Newell at Valve, and to Steve Jobs, who I believe have collectively had the biggest impact on this transformation in industry politics through the advent of download technology. The reality as I see it: I am in on the ground floor of something that is a virtually brand-new industry, and I truly believe that the dynamics of the old titans in the industry are going to have to dramatically change or soon they will be gone – the same I expect to see with the console and the DVD."



Zombie Playground. Y'know... for kids.

Obsidian's *Project Eternity* hit nearly $4,000,000 on Kickstarter.

OCULUS RIFT

VR has been attempted many times, but remains one of the unfulfilled dreams of 1980s science fiction. *The Lawnmower Man*, *TRON*, Robin Williams's *Toys* – VR was the future, but every single device that's been developed has failed. The resolution hasn't been high enough, people using it have become nauseous, and the tech has been bulky and unusable. The difference with the Oculus Rift is that it satisfies the current generation of nerds' concept of what VR should be.

Oculus CEO Brendan Iribe admits VR hasn't lived up to nerd dreams. "Every headset that has come out, every VR has been pretty disappointing. For the first time, you've got this headset and you're suddenly in the game, you're looking around, it's tracking perfectly to your head, so your eyes are the camera. You can look and move around in the game very seamlessly."

John Carmack, creator of *DOOM* and *Quake*, is an admirer, calling it "a gaming experience with a level of immersion genuinely unlike anything else we have ever encountered". It does this through a combination of a high field-of-view, low latency and special tech to counter motion sickness.

Despite these positives, we're not entirely convinced. The kit still has to be less bulky and the 640 x 800 resolution per eye needs to be higher. And we're not convinced that 3D is necessary at all, or that the motion sickness problem has been fixed. But enough people have now paid for it that it's a certainty it'll enter mass production. It, like our other two examples, reached 10 times its goal, raising $2,500,000 from nearly 10,000 backers. It's also being heavily backed by FPS game developers, including Carmack, Valve's Gabe Newell and Epic's Cliff Bleszinski. The stunningly beautiful mech game *Hawken* is also going to support it out of the box.

Famous developers like Brian Fargo of *Wasteland*, Tim Cain of *Fallout* (who left his publisher-driven MMO *WildStar*) and Chris Avellone of *Planescape: Torment* have all moved their projects to Kickstarter. "Look at now versus three years ago," says Fargo. "How many independent studios are carving out businesses for themselves? And we all have different niches. One guy might do a fly-fishing game, or a train simulator. He's got his audience and he sells to them and he's got a great business for himself. We're already seeing a lot of really talented people leaving the publishers to do what we're doing."

Obsidian's *Project Eternity* hit nearly $4,000,000, again with little initial detail. Fargo's *Wasteland 2* hit nearly $3,000,000. *Planetary Annihilation* (a modern day *Total Annihilation*) reached $2,300,000. *Shadowrun*, an old RPG series, got $1,900,000 for a 2D RPG for tablets

and PC. *Homestuck Adventure*, an adventure game based on a popular web comic, got $2,400,000. A new *Broken Sword* adventure game got funded ($700,000), despite the last iterations being disappointing. *Carmageddon*, a long-dead and much-beloved destruction derby game, got $625,000. Neal Stephenson, author of *Cryptonomicon* and *The Baroque Cycle*, got $500,000 to make a motion-controlled sword game. And so on.

Notably, either from the start or in 'stretch goals' – when developers say what they'll do with all their extra cash – many of these developers have pledged to support Linux and Mac games. Given that many of them are developing in the Unity engine, they're aware that at low cost, they can make ports to other hardware platforms relatively easily. By making the developers realise that an unserved audience is there, desperate for games, Kickstarter is changing development.

For developers, it also means that they can talk to their community about the game; for many, no part of the publishing or marketing model was working.

Tim Cain, now at Obsidian, says: "With Kickstarter, we are free to talk about the game during all the stages of its development. We have a better idea of what features are important, and the fans can follow the game's development and be more involved with it."

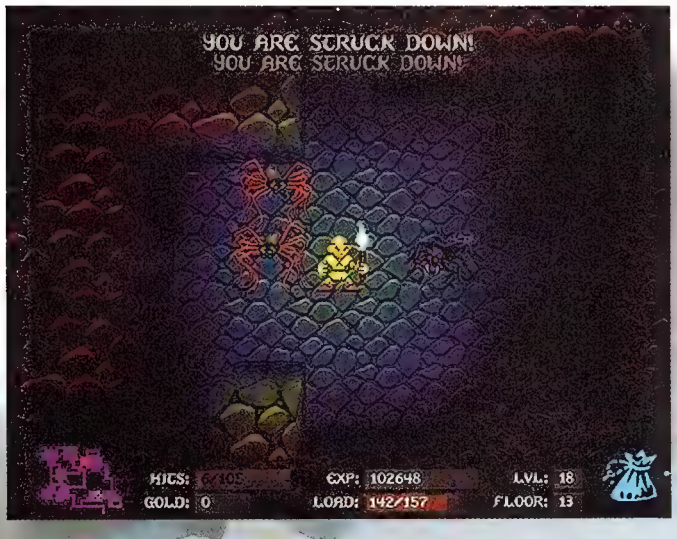
KICK IN THE TEETH

There have been high-profile failures, though. *Wizardry* lead designer Brenda Brathwaite and *DOOM* creator Tom Hall pulled their Kickstarter for an 'old school RPG' because they felt that fans were funding it without actually knowing what it was. It's noticeable how many games projects have focused on nostalgia rather than innovation. All the largest and most successful projects have been adventure games and RPGs – genres that have been stagnant for a long time.

Worse, *Haunts*, a small horror game, received $28,000 from Kickstarter, but the developer had to put the project on hold indefinitely, as it had run out of money and programmers. Given that most punters go for the cheapest option that will give them a copy of the game, the 12,000 people who funded *Haunts* may feel aggrieved. They thought they were pre-ordering a game, but if it shuts down then they've lost their money.

And not all Kickstarters get funded. If you're a small indie with no big names, you have to aim much lower in your goals, and be prepared to do so. Keith Burgun from Dinofarm Games has talked about the failure of the Kickstarter for his tactical dungeon-crawler *Auro*, emphasising the need for good communications. Successful pitches on Kickstarter are supported by a reasonable video, regular blog updates, sensible goals and attractive payment tiers. Burgun recommends playing it straight and waiting until you've got something to show. And if you don't get the cash, don't be discouraged – work out why not and try again.

Philippe Chetrit, CEO of event crowdfunding platform Tixelated, agrees. "The key to a successful campaign is a clear and precise return on a contribution," he says. "We've seen countless campaigns fail on our platform due to people's faith in a good idea."



Risque **reckons it's learned from its mistakes and is back for a second go at funding.**

Carlos Solorio of clothing Kickstarter Arden Reed says competition is increasing and that "campaigns are getting more sophisticated. Now companies going into a KS campaign are usually advised by several mentors and consultants – not to mention the professional videographers/screenwriters that have emerged from this industry."

Publishers are learning, too. They won't become extinct, but they'll have to change. "It's pretty scary when you're a publisher and you have to fund games because that's what you need to go ship," says Obsidian's Feargus Urquhart. "But now maybe some titles can come to you secondarily, or for distribution, or something like that where you don't have to worry about a cash outlay so much." For the $20-40 million multi-SKU console game, that's not the Kickstarter world. However, for titles cheaper than that, he says: "We're getting the opportunity to go build a brand, and it's a brand that we own. And that's what changes the power a little bit."

THE NEW WAVE

One interesting new platform is Gambitious, which offers the crowd equity in the project (so if the game makes a profit, the funder gets some money back) and acts like a publisher. "It's crowdfunding 2.0 – new wave publishing," explains one of the site's founders, Andy Payne OBE. "It's not just raising lots of money, it's making sure the project goes somewhere. We're going to have a board of experts to help developers get their pitch right, make money out of it and act as guarantors."

"Games are getting more expensive to make. When I started, apps were $77,000. Now it's $383,250. It will be up to millions on pocket computers in a couple of years. I think we'll see hybrid models – a bit of crowdsourcing to prove a concept is popular, then equity, then bigger equity coming in to take bigger slices. A hierarchical wisdom of crowds model."

It's likely that Kickstarter will adopt elements of this, especially now that the JOBS (Jumpstart Our Business Startups) Act has passed in the US – something designed to reduce regulation on crowdfunding. As Money Crasher's Andrew Schrage told us, analysts predict the JOBS Act will help the industry grow to $500 billion in 2013. But growth in new industries tends to mean consolidation or venture capitalists buying everything out. Payne predicts Kickstarter will be bought soon. "They're the Facebook and Twitter of crowdfunding. They have a fantastic vertically sliced community, and make lots of money from their transaction model. They will probably sell themselves to a financial institution – banking or venture capitalism."

For the future, Solorio feels the platform is 'crossing the chasm' to mainstream crowdfunding. "I think you're going to start seeing entire industries shift to this funding platform. Especially those that were constrained by outsized capital needs." Of course, with the Western economies still in the doldrums, all capital is constrained, so perhaps every company will shift to Kickstarter. Perhaps the crowds aren't so mad after all. EDGE

For all the successful *Sword of Fargoal 2*s around, there are more unsuccessful projects, such as *Risque*, above right.

UNLEASH WINDOWS 8

Microsoft's brand-new OS is specifically designed to take advantage of touchscreens. We test the touch PCs, hybrids, tablets and laptops that are designed to give you the best Windows 8 experience.

There's no real way to avoid the fact that to get the most from Windows 8 (and we'd even go as far as to say to use it effectively), you'll need a touchscreen device. PC makers have been quick to take up the challenge, however, and there's a boatload of new touch-driven laptops, all-in-one desktops and tablets, of course, flooding the market.

In particular, the latter are seen as vitally important to Microsoft and help explain the radical direction it's taken with Windows 8. There's been a major shift in the computers we've been buying since Windows 7 was released three-and-a-half years ago. People have been supplementing their laptops and desktops with smartphones and tablets, and as these devices have grown in horsepower they've taken more central roles in our computing lives. For Microsoft to stay competitive, it needed to do something big and the result is Windows 8's new Modern UI.

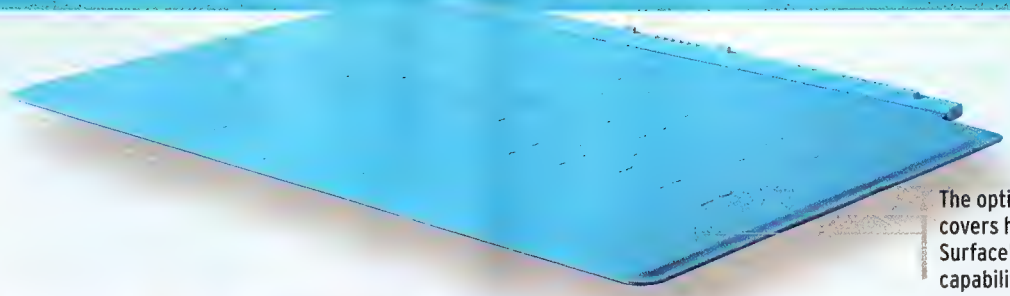
The new interface (formerly known as Metro) is basically Microsoft's new 'Start' menu and in fact, it's controversially replaced the old 'Start' menu we've all been using since Windows 95. The Modern UI was designed with one specific technology in mind: touchscreens. You don't technically need a touchscreen device to use the Modern UI, but it does make for a better experience – there are many interface elements and shortcuts that are less fiddly to trigger if you have touch as opposed to a mouse and keyboard.

The devices that are made to capitalise on touch are a wide and varied bunch. Some are just older designs with touch grafted on top (such as Dell's XPS One 27), while others are all-new takes on convertible laptop-tablets – Sony and Toshiba have some slightly oddball (but not entirely unappealing) examples of this. The biggest change is, however, driven by the introduction of a reworked version of Windows 8 called Windows RT: it's an OS specifically for tablets.

Windows RT only runs on ARM-based hardware – the same class of chips that power Apple's iPads and iPhones and every Android tablet and smartphone under the sun. ARM chips are appealing for two main reasons: they're comparatively inexpensive and they deliver very good battery life. Windows RT has one notable limitation compared to Windows 8 in that it can't run legacy Windows apps, only Modern UI ones downloaded through the integrated Windows Store.

Clearly, Microsoft takes the iPad and Android tablet threat very seriously and it's even designed its own range of tablets, called Surface, to compete. Surface will initially come in two flavours and we've reviewed the first unit, running Windows RT and using ARM hardware, for this feature. Surface Pro tablets that run on traditional x86 laptop parts and use the full version of Windows 8 (and can thus run legacy software) are due to arrive in the first quarter of 2013.

Time will tell whether Microsoft got it right with Windows 8 and the hardware plays a key role. Read on to find out how the initial lineup stacks up.



The optional Touch and Type covers help beef up the Surface's productivity capabilities.

7/10 MICROSOFT SURFACE WITH WINDOWS RT

If you build it, will they come?

www.microsoft.com/surface @

From $559 $

Includes real Office apps, USB and microSD sockets, hardware keyboards. ✔

Some holes in the app ecosystem, internal hardware a little underwhelming. ✖

A built-in kickstand means you can prop the tablet up for watching videos or typing.

We saw minor scratching around the screen edges after a week of use, even when using a cover.

Surface with Windows RT is Microsoft's biggest hardware launch since the original Xbox in 2001. The internally-designed tablet is also a big gamble; running a cut-down version of Windows 8 called Windows RT, it's the software giant's big shot at gaining a foothold in the blooming tablet market, an area where it's fallen badly behind both Apple and Google. In comparison to those competitors, Surface makes a bold (but indirect) promise of delivering better productivity chops than Android or iPad. There's the option of buying a Microsoft-made snap-on keyboard cover, but a bigger part of that promise comes from Microsoft Office. Office is so critical, in fact, that Microsoft's bundled the Home & Student Edition directly in with the Windows RT OS, which means you get Word, Excel, PowerPoint and OneNote straight out of the box.

GETTING PRODUCTIVE

To cut straight to the chase, the good news is that Office on Surface is basically identical to the regular PC version. If you've used any post-Ribbon version of Office, there's little to no learning curve with these RT versions. Microsoft's message seems to be that real work needs to be done in the traditional fashion and it hasn't messed with what already works. Office RT 2013 even lives in a faux-desktop environment, which also houses desktop facsimiles of both Windows Explorer and IE10, and like regular desktop apps

they're all best driven with a mouse and keyboard.

That's both heartening and disappointing. It's heartening because anyone can just start using it. It's disappointing because it means that to really use Office effectively, you need the traditional mouse and keyboard combo (or at least one of Microsoft's Type or Touch smart covers). You can still use Office without the latter, and Microsoft's made some mild adjustments to the Office menus so that they can (mostly) be tapped through without needing the precision of a pointer. Some interface elements, such as individual cells in spreadsheets, can be a little small to tap, especially for the large-fingered. Likewise, the onscreen keyboard does have some nice tools for editing and entering text (such as arrow keys and a numpad), but it takes up half of your screen all the same.

One thing that does work well is that, by default, Office prompts you to save any documents you create to your SkyDrive online storage bank, Microsoft's answer to Dropbox and Google Drive, which is included free with a Microsoft account. That means you can then get to them from anywhere with internet access and edit them using Microsoft's Web Apps.

TOUCH VS. TYPE

So how efficient are those magnetic, snap-on keyboard covers? We were provided with samples of both for testing, and both were reasonably impressive. While we do prefer the Type, with its genuine mechanical keys and physical feedback, the pressure-sensitive Touch does work better than we expected. The fuzzy felt keys are slightly raised and surrounded by smooth spacing in between, which means you can still feel when you're hitting the edge of a key. We did find that the Touch somewhat ironically requires a bit more precision and pressure to register keystrokes than the Type, which may result in more finger strain over prolonged periods.

However, both are a little tricky to use on your lap. It's not too difficult to actually balance the Surface (with the kickstand out) on your lap, provided you put your legs together. But tapping on the keyboard makes things bounce around quite a bit, as it's not as sturdy or comfortable as a laptop.

The keyboard covers do trump any onscreen tablet keyboards we've used, though in Windows RT's case, the software keyboard is one of the best around. It's fast, responsive and generally well laid out.

DOING WHAT OTHER TABLETS CAN'T

The Surface does offer some great hardware and software features that aren't always present in its Android and iOS competitors. That includes a USB 2.0 socket for plugging in external drives or peripherals, plus a microSD slot for bulking up the internal storage. Physically, this ARM Surface is a solid-feeling hunk of tech and its angled edges have a coolly professional feel. The moulded magnesium casing resists flexing, but did suffer from some paint scratching after a week of use.

From a software perspective, having Windows Explorer likewise means you can access files on the Surface's hard drive or browse network shares natively, and overall it does integrate quite easily and swiftly into an existing Microsoft network environment – be that at home or the office.

Those features combine to make getting files on and off the tablet a snap. Want to watch a movie? Just throw it on a USB flash drive, microSD card or put it in a network-shared folder on your PC and copy it across. No plugging the Surface into your PC (or messing with syncing iTunes) to worry about.

There are also some neat software-docking features that are unique to Windows and make the Modern UI more usable. For example, you can dock a chat app off to the side of the screen while you're working on a document, surfing the web or watching a video using the rest of the screen. Indeed, some apps even seem specifically designed to support being docked.

Learning all the Modern UI shortcuts and gestures makes using it reasonably fast and flexible, but that education process isn't always smooth or intuitive.

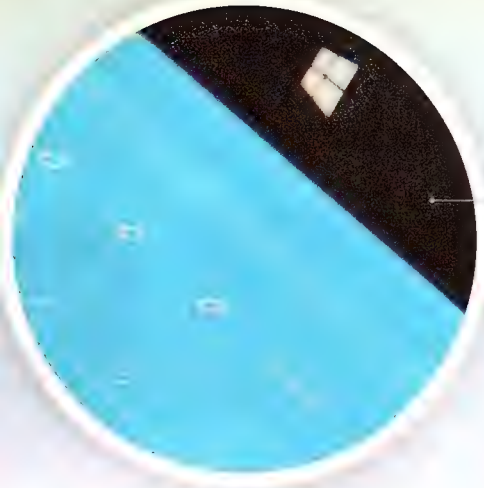
THE FUN STUFF

A tablet PC shouldn't just be about work, of course – gaming and media consumption are arguably even more critical. It's ironic then that the Surface is a little uneven here. Both Windows 8 and RT include good media basics in the form of the Xbox Music, Video and Games services. Xbox Music and Video primarily serve as stores, where you can purchase a subscription to stream music (you'll get a free-six month trial when you start using a Windows 8/RT device for the first time) or rent or buy movies and TV shows, respectively.

The Music and Video apps also double as the OS's default video and audio file players. They're basic yet functional for these tasks, supporting generic file formats like AVI and MP4 movies, but not more esoteric ones like MKV (there's likewise no support for subtitles in the Video app).

Microsoft doesn't yet offer its own ebooks service and unsurprisingly, Google and Apple's services aren't available here. Amazon does have a Modern UI Kindle app available on the Windows Store, though.

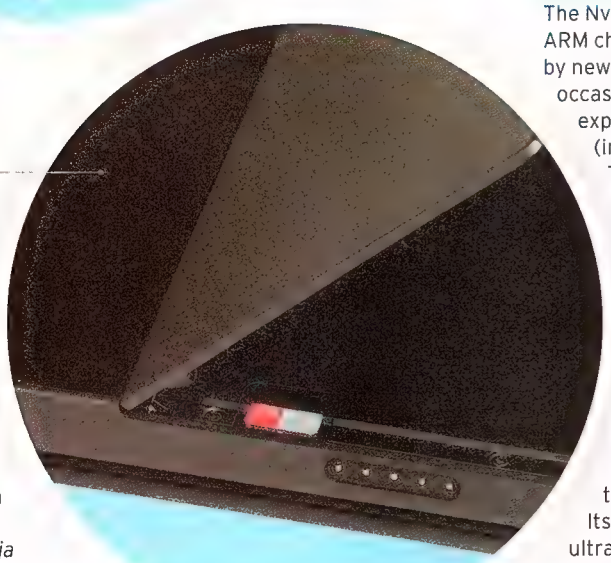
Considering its relative youth, the gaming options on the Windows Store are better than you'd expect. While it's true that many of the best and biggest titles available are either Microsoft developed or published,



The keys on the Touch Cover are slightly raised and differently textured to the surrounding space.

The Surface feels like its made to be used in landscape mode, with a power button on the long edge and volume on the side.

Flicking out the kickstand also gives you access to the built-in microSD slot.



there's a handful of big-name games from outside studios, too: *Angry Birds*, *Fruit Ninja* and *Cut the Rope*, for instance.

The variety of smaller indie-built games is a little lacklustre, as is support from newer gaming juggernauts like Zynga and Gameloft – or even just the mobile arms of EA and Activision. Microsoft's been in the gaming business much longer than either Apple or Google (and it has the Xbox in its arsenal), so it clearly realises the importance of gaming on a tablet. It needs to get more developers at the party if it wants the fun to really start.

THE APP GAP

As we've intimated above, the really big problem for Surface is app availability. The Windows Store is sorely lacking in app variety, even from the big players in the market, where you'd expect some attention to have been paid. There's no first-party apps for some critical web services such as Facebook, Twitter and Dropbox, for example (while the former two are technically integrated into Windows 8's People hub, that one-size-fits-all solution isn't particularly flexible, giving you one long sideways-scrolling timeline of all your updates with no options to filter or drill down). There are some decent third-party social media apps, but surprisingly few big names among them – no HootSuite or TweetDeck, for instance.

Reading and news are also middling at best. As we've mentioned, there's an official Kindle app, but not a lot outside this. The better 'read it later' services (like Pocket and Instapaper) are currently no-shows, as are the bigger social reading apps like Flipboard and Pulse, which pull in content from your Facebook and Twitter accounts along with RSS feeds. The third-party reading and news options we tested here were single-developer products that had some way to go in both speed and usability.

Australia-specific apps do fare a little better, but are still a mixed bag. There's a decent Westpac banking app, for example, but Commbank, St George and NAB customers will have to make do with using the usual web sites. Likewise, it's encouraging that both the SBS On Demand and Network Ten catch-up apps are available already (SBS's is a great example of what a Modern UI app should be), but ABC iview and the Nine and Seven equivalents are sadly not to be found.

If you're like us, there are probably a few key services and programs that you rely on for work and fun. There's no guarantee that you'll be able to find native apps for them on the Windows Store. RT's faux desktop does somewhat make up for this – with IE10 and Windows Explorer, you at least have the option to use a service's web interfaces and access the Windows file system directly.

In all, it adds up to a rather hodgepodge offering. If you're coming from either an Apple or Google tablet, you'll find the app experience sorely wanting. If Microsoft hopes to compete, it's this area that needs the most attention.

NEEDS MORE SPEED?

The Nvidia Tegra 3 processor inside the Surface is a reasonably powerful ARM chip that's also used in many Android products. It has been eclipsed by newer chips in both the Nexus 10 and iPad 4, however, and it can on occasion also prove to be a little laggy running Windows RT. We never experienced anything show-stopping, and Microsoft's own apps (including those in the Office suite) were generally problem-free. The same can't be said for third-party apps, though, which weren't always as snappy to start or respond as we'd like. In most cases they're not unusable, but they do seem very much like the first-generation apps they are. While there are some good ones out there (note-taking app Evernote being a keen example), many lack the speed, polish and flexibility you can find on their iOS and Android counterparts, and can be frustratingly slow at times.

Other areas of Surface's hardware are also a little bit underwhelming. While the 1,366 x 768 pixel LCD screen never looks overtly pixelated and has great viewing angles, colour and contrast, it lacks the sharpness of the best iOS and Android tablets – competitors that are selling for similar (or lower) prices. Its weight is also problematic. While it's light compared to even an ultrabook, at 680g sans keyboard cover, it's weightier than the iPad (650g) or Nexus 10 (600g) and not very comfortable to hold one-handed for prolonged periods.

A TABLET FOR PRODUCTIVITY

Surface isn't always elegant, or cutting edge, but if you want a tablet that can replace your laptop, this one gets the job done adequately. To really compete in the current tablet market, however, it needs to be more than just a laptop replacement – it needs to be a great tablet with a great variety of apps, too.

What Surface shows is that Microsoft knows how to build a classy and compelling tablet PC. If we had to choose a tablet for productivity, this'd be it. If we had to choose one for fun, the iPad and Android options – with their much broader range of apps and games (and more consistent performance) – still win. Hands down.

WINDOWS 8 PORTABLE HARDWARE

The launch of Windows 8 brings with it a diverse range of new touchscreen-driven portable devices. Bennett Ring and Dominik Krupinski test eight of the first to market.

Desktop users might be wondering what all the fuss is about, but if you interact with your computer via a touchscreen, then there's plenty to like about Windows 8. Built from the ground up for these finger-friendly devices, Microsoft's latest cash cow is expected to spark a flood of touch-enabled tablets, convertibles and ultrabooks. With two different flavours of the new operating system powering these upwardly mobile gadgets, not to mention a plethora of new devices just waiting to be covered in greasy fingerprints, it's a good time to take a look at this rapidly expanding category.

WINDOWS 8 OR RT?

Regular *APC* readers will likely be fairly familiar with Windows 8, but its cousin, Windows RT, isn't quite as famous. If you were to look at two tablets side by side, one running Windows 8 while the other runs RT, you probably still wouldn't be able to immediately pick the difference between the two. However, under the bonnet they differ in one very important way. Windows 8 is designed to run on traditional x86 processors that have been powering PCs for decades, such as Intel's Atom/Core or AMD's Trinity/FX series. RT is instead built to handle the new breed of ARM processors that are taking the tablet and smartphone world by storm (Nvidia's Tegra 3 is one of the most popular tablet ARM CPUs, for example).

This has one very important impact. While Windows 8 is compatible with almost all pre-existing Windows Vista/7 software, which can be run through the Windows 8 desktop, Windows RT is not. If you go for an RT tablet, you'll need to buy apps specifically designed for the new OS – there's no way to run your old legacy software. That's the most important factor for prospective buyers of these devices: you need to consider how critical your older Windows software is. If you find there are programs you can't live without, you'll need to check through the available Windows RT applications (also known as 'Windows 8 style' or 'Modern UI style' apps) to see if there are any that can do the job instead. RT is also lacking a few of Windows 8's features, such as Windows Media Player and Storage Spaces, but the differences here are minimal. Finally, you can't actually buy RT, as it's only available preinstalled on an ARM-based tablet, whereas Windows 8 can be purchased. It sounds like there's not much of a reason to buy RT devices, until you look at the price. ARM processors tend to be much more affordable than x86 devices, which means RT-powered products will generally have lower price tags than their Windows 8 relatives.

TABLETS, CONVERTIBLES & HYBRIDS

Along with touchscreen laptops and all-in-one desktop PCs, the new touch ecosystem is being populated by systems that dare to do things a little differently to the traditional laptop/desktop paradigm. Tablet PCs, aka slates, are just like the iPad: a large touchscreen around 10in across, with no built-in keyboard. Hybrids are simply tablets that come with a docking keyboard that can be attached, giving users the benefit of keys they can feel, and often including an extra battery and I/O ports in the base. Finally we have the convertibles – laptops that use hinges to allow the display to rotate or slide to turn the unit into a tablet. Within these categories are many variations on the theme and manufacturers are continuing to experiment to find that killer design.

It's a very interesting time for portable computing. The culmination of years of power-saving, touch recognition and miniaturisation R&D are all coming together to deliver an exciting new computing experience. When plugged into our increasingly connected world, these lightweight machines can transform into various incarnations best suited for the needs of the moment, and the range of price points is almost as great as the various form factors available. Here we've checked out a variety of the latest Windows 8/RT machines that will allow your fingers to do the walking.

2GB DDR3 1,066MHz MEMORY

1 YEAR MAIL-IN WARRANTY

WINDOWS 8 32-BIT

8/10

Acer Iconia Tab W510

Windows 8 for the price of RT.

www.acer.com.au @

$799 $

Fantastic battery life, very portable, solid performance. ✓

Not a lot of storage, screen bounces when docked, no GPS. ✗

It might not be quite as cheap as the most affordable Windows RT tablets, but Acer is definitely aiming for thinner wallets with this Windows 8-powered hybrid. Bought without the keyboard it'll set you back around $700, putting it right in line with Apple's iPad 4 and other Windows RT devices, with the cost rising slightly if you shell out for the extra keyboard. Doing so does deliver more than just a keyboard, however – you'll also get incredible battery performance courtesy of the keyboard's second battery.

We started our standard PowerMark test early in the afternoon and left it running overnight. The result was an astonishing 12:10hr, and the device still had so much juice left that the display was still active the next morning. This is simply incredible, bearing in mind that PowerMark puts devices through far more strain than most average users do in a standard day's work. It's not just the dual batteries that keep this tablet going when others have long since given up the ghost, with Intel's Atom processor also responsible for the lengthy battery life. Our review unit included the Atom Z2760 version, a dual-core, Hyper-Threaded chip that runs at a maximum of 1.8GHz under load. It's not in the same league as the Core i5 CPUs we've seen in more expensive tablets, as evidenced by the rather low PCMark 7 results. Yet performance when surfing the net or churning out Word documents was fine. It's a full-blown x86 CPU, which means this tablet runs the full Windows 8 OS, which remained responsive even with multiple apps open.

In tablet form, the W510 looks like a standard 10.1in slate. The use of Gorilla Glass keeps the screen scratch-free and extends from edge to edge, like most other Windows 8 tablets. An aluminium rear further reinforces the sturdy construction, and also keeps the weight down at just 580g (without the docking keyboard). At this price you don't get an HD display, although the 1,366 x 768 resolution is fine for most duties. It's an IPS display, the norm in these form factor tablets, and image quality was decent if not dazzling. Touch response on the 10-point screen was lag-free and accurate. The screen clips into the keyboard dock via a very sturdy clamp, but there are no support struts, like those seen in the Sony on page 54, to stop the screen moving when it's touched. As a result, using the touchscreen when it's mounted on the base isn't the best experience, as the display tends to bounce around a little. This issue isn't unique to the W510, but it's worth mentioning. The display can be rotated past the vertical, turning the keyboard into a base station – a handy feature for group presentations or watching movies.

The keyboard itself is a very petite unit, matching the same dimensions as the 10.1in display. The island keys felt a little small, but with practise are much more expedient than using a virtual keyboard on the touchscreen. Despite the smaller length and width, it's quite deep to accommodate the extra battery, with the positive side effect of allowing extra I/O ports. There's a microSD card reader, microHDMI port and two USB 2.0 ports, one of which is the micro format; sadly, USB 3.0 support is AWOL, as is a GPS unit. If there's an Achilles' heel, it's the W510's storage – 64GB of flash memory simply isn't enough for many users, which will have to be alleviated with a microSD card, external drive or cloud storage.

Acer has delivered a very usable little Windows 8 tablet in the W510 and if your storage needs are slim, the sturdy construction, light weight and incredible battery life make this a tempting tablet hybrid.

- 4GB DDR3 1,600MHz MEMORY
- HD WEB CAMERA
- WINDOWS 8

7/10

ASUS Taichi 21

Are two displays better than one?

www.asus.com.au @

$1,750 $

Zippy CPU and specs, decent amount of storage. ✔

Twin displays, no GPS/mobile data. ✖

We're used to seeing interesting designs when it comes to Windows 8 tablets and convertibles, but the Taichi takes the cake for originality. Sitting in front of it with the lid open, it appears to be yet another run-of-the-mill ultrabook. Flip the lid closed, though, and the magic is unveiled – there's a second display mounted on the exterior of the lid. In this configuration it operates just like a regular tablet, albeit a rather chunky one. There's nothing else quite like this twin display configuration, but does that mean it's any good?

To be frank, the Siamese displays feel more like a gimmick than a killer feature. The sole advantage offered over and above a regular convertible is the ability to run both displays at once, which could possibly make showing presentations to larger groups easier. However, to do so requires the screen to be perfectly vertical, which makes viewing angles less comfortable than sitting in the front row at the movies. Some might also argue that the lack of a rotating hinge should ensure a longer lifespan, but most convertible hinges these days are built to withstand a direct nuclear attack.

There might be one advantage to this twin-display design, but there are multiple disadvantages. Squeezing two displays into the lid is obviously going to weigh more than a single screen, and at 1.25kg it's rather heavy compared to some of the lightweight competition. To its credit, ASUS has managed to keep the lid nice and thin, and the entire device depth is a mere 17mm. A nice range of inputs and outputs have been fitted to this depth, with twin USB 3.0, microHDMI, mini VGA and even a port that accepts an RJ45 LAN adapter. The two 11.6in screens are also premium components, with crisp HD resolutions of 1,920 x 1,080 pixels and excellent image quality. Only the exterior screen is touch-enabled, though, so you'll have to use the trackpad with Windows 8 when it's in laptop mode.

The final issue is battery life: while we didn't test it with both screens enabled, it'll undoubtedly make the already short battery life even smaller. With only one screen active battery life doesn't seem to have been hurt by the twin displays too much – while it's still low compared to some of the other ultraportable devices, the running time of 140 minutes is rather standard for a machine running such a speedy processor. Most of the juice is directed to the dual-core Core i7-3517U CPU, which also includes Intel's integrated HD4000 graphics, with the rest helping to power a 128GB SSD and 4GB of DDR3-1600 memory. Four gigs isn't a whole lot of RAM, but its performance was nothing less than impeccable, even when both displays were active. The 128GB SSD is rather large compared to most tablets, yet it's only middling by ultrabook standards; thankfully, a 256GB upgrade option is available. The absence of both GPS and 3G/4G support means this machine isn't perhaps well suited to a life on the road, but these features aren't yet common in convertibles.

We're not sold on the idea of twin displays and it's obviously come at the cost of other components. If you can find a good reason to use both screens, there's nothing else quite like the Taichi, although it feels more of a proof of concept than a usable solution.

HIGHLY apc RECOMMENDED

2MP FRONT/8MP REAR CAMERAS

1 X USB 2.0 PORT

WINDOWS RT

8/10

ASUS VivoTab RT

The baby of ASUS's Windows 8 bunch.

www.asus.com.au @

$599, $749 with keyboard $

Snappy performance, very affordable, GPS and 3G. ✓

Average display quality, Windows RT OS, lacking storage. ✗

ASUS has gone all out with the launch of Windows 8, unveiling a whopping five different tablets, convertibles and ultrabooks. The VivoTab RT is the most portable of the range; however, it's also the least powerful, with an ARM-based Nvidia Tegra 3 CPU doing all of the heavy lifting, which means it's limited to the Windows RT OS – it's basically ASUS's version of the Microsoft Surface.

Testimony to the efficiency of the Tegra 3 is the fact that its responsiveness was never anything less than impressive. No matter how many apps were open at once, they'd respond to our input almost instantly.

ASUS's experience building Android tablets also shines through in the overall design. Without the keyboard, the tablet weighs just 525g, and it's as skinny as it is light, with a depth of just 8.3mm. The screen measures 10.1in across and ASUS has used scratch-resistant Corning Fit glass. The polished aluminium back is reassuringly sturdy, with a plastic strip that extends across the top inch or so of the rear, likely to ensure clearer radio (GPS, Wi-Fi, 3G) reception.

The 1,366 x 768 display here means Windows RT is much more readable when the OS is set to the default font size. Individual pixels were easy to spot if we really tried, but reading web pages and using the mail client still looked pleasingly sharp. Videos were a different matter though, where the pixel structure was hard to ignore. More concerning was the average contrast performance, which made any dark videos look as if we were viewing them through sunglasses.

A 3G (HSPA+) radio is built in, along with 802.11 b/g/n – there's no 4G as yet. We're also guessing there's a slight networking bug on this device, as the VivoTab couldn't detect any of the shared folders on our Synology NAS server, whereas every other Windows 8 tablet we tested immediately picked them up.

The keyboard dock clips into the tablet via a simple yet rugged locking mechanism – the solid feel to it suggests a strong connection over extended use. The island keyboard is a little bit cluttered, but this compromise had to be made to include the full-sized keys. The small touchpad at the bottom of the keyboard was extremely accurate and clicking felt just right – not too heavy, not too light. Compared to Microsoft's Surface keyboard, though, the VivoTab dock is a behemoth at 8mm in depth. However, this means it's wide enough to fit a dedicated USB and microSD port, as well as a second battery.

While we couldn't run a comparative power benchmark on this machine (or any other test, given the nature of Windows RT), ASUS claims a total battery life of 16 hours. We managed 10:43hr in a video playback test sans dock, so we're confident it'll easily do a full day's work between charges. Like several more affordable tablets we've seen, the VivoTab's storage space can only be described as anaemic, with a mere 32GB as the standard option, increasing to 64GB if you want more.

ASUS has delivered a versatile package here that's also one of the most affordable hybrid tablets available. While some corners have had to be cut to keep the price friendly – most notably, the screen quality and storage – the good news is that the Windows RT experience is sharp and snappy. It's a solid choice if you don't need the software support of Windows 8 or the storage of a more expensive tablet.

TOUCHSCREEN LAPTOP
CORE I3 CPU
320GB HARD DRIVE

6/10 HP Envy TouchSmart Ultrabook 4-1121tu

Not a tablet, but still quite touchy.

www.hp.com/au @
$1,149 $
Relatively inexpensive, looks nice, large screen. ✔
Inferior specs, battery life. ✖

The launch of Windows 8 has certainly been a boon for lovers of novelty, with hardware vendors falling over themselves to implement Microsoft's touch-centric OS in unique and conceivably useful ways. We've seen twisting, flipping, sliding and even doubled-up screens utilised to get laptop users close enough to their displays to cop a feel, and in that environment of rampant creativity, HP's 'just slap a touchscreen on it' attitude to this pseudo ultrabook is arguably refreshing (if possibly lazy).

To be fair, while the Envy doesn't move laptop design forward, nor does it ask a substantial price premium for untested technology. Being the least expensive model in HP's Envy TouchSmart lineup, what you do get here is an entry level 14in ultrathin laptop with the added bonus of a screen that happens to be touchable, all for a relatively inexpensive $1,149.

With a Core i3 CPU and platter-based hard drive, the Envy's humble internals also include a 32GB cache SSD. At 1,366 x 768 however, the TN screen can't hope to outshine the higher resolution, more sophisticated displays found on some pricier machines. But this laptop does at least live up to its 'Envy' branding – it's got a svelte, corporate chic design – and for most office workloads, we can't imagine the performance would really be an issue. We typed this review on the generally pleasant chiclet keyboard and the lowish PCMark 7 score certainly doesn't show; both the Windows 8 interface and occasional dawdle-prone YouTube video are slick and responsive.

The invitation to occasionally swipe an element left or right via the touchscreen, rather than navigate Windows 8 wholesale as more touch-focused tablets allow, also isn't entirely unpleasant. It makes for an effective distinction between work (such as typing and touchpad navigation) and faffing about (ie. swiping between programs to load a video or what not) that kind of works for us. At least until Windows 8 gets some more eye-catching apps and we can really waste some time with it. Indeed, if the Envy is going to turn any users off, it'll be its value breakdown and a couple of quality issues that do it, not a fixed screen.

Quality first. While it looks nice, we were disappointed in build quality. In particular, the Backspace key on our review sample continually came loose, and an inconsistency in the coating of the screen and touchpad (one glossy, the other matte) made general navigation feel unintuitive – it's like switching between two different PCs. Battery life is also a bit low, given the low-end display and CPU – we'd expect more than 3.5 hours.

But the real kicker is price. By touchscreen laptop standards, it's fairly cheap, but it's not that much cheaper. Dell's (admittedly smaller) XPS 12 costs around as much and comes with a higher-resolution screen, faster CPU and SSD, not to mention a flip-around screen that lets it double as a tablet. Likewise, other vendors make a better case for dollars spent. All of which leaves us in an awkward position. There's no denying that it's cheaper than many full Windows 8 tablets, but with the hardware for Microsoft's new OS being more about gadget appeal than practicality at this stage, we'd have to say that this is a non-essential purchase.

- 4GB DDR3 1,333MHz
- NO GPS OR 3G/4G
- WINDOWS 8 64-BIT

7/10

Lenovo ThinkPad Twist

Let's twist again.

www.lenovo.com/au @

$1,049 $

Affordable for this size, large screen and keyboard, speedy CPU. ✔

SSD will cost extra, plastic construction, large dimensions. ✖

By the standards of most other convertibles, the Twist is a behemoth. Weighing around 1.6kg, it's almost as big as a 14in ultrabook, making it far less portable than many of the new wave of Windows 8 devices. It's still not a backbreaker by any stretch of the imagination, but it's not going to fit in a handbag either. For those who are mostly chained to their desk this is actually a plus, as it allows for a much larger keyboard. Unlike most convertibles, the keys here don't feel as if they're designed for children. There's also a generously-sized trackpad, along with a pointing stick in the centre of the keyboard, just in case you'd rather not smudge up the touchscreen.

In its infinite wisdom, Lenovo has graced the Twist with a glossy screen, which makes it hard to see outdoors as well as a magnet for fingerprints. We can't really single out the company for this, as every other Windows 8/RT device features the same shiny finish. The large dimensions provide ample space for a 12.5in Gorilla Glass display, but it's rather low resolution at just 1,366 x 768. Considering there are smaller convertibles with HD displays, the low pixel count here is a bit of a disappointment, but it's obviously helped keep the cost down. The screen rotates on a central circular hinge – there's nothing else to support the display, so it suffers from the trampoline effect we've noticed on other convertibles and hybrids, bouncing around when touched.

Rather than the slick brushed aluminium casing most convertibles and tablets use, the Twist is built entirely from black plastic. To be frank, it looks a little cheap in comparison, even though it's probably just as happy to handle a knock or two. The depth of the chassis allows for a decent range of I/O options, with twin USB 3.0, HDMI, RJ45 and a stereo audio minijack. While the exterior of the Twist isn't exactly glamorous, the interior is more impressive. Our review sample came equipped with an Intel Core i5-3317U processor, seemingly the new darling of the Windows 8 world, and its dual Hyper-Threaded cores whipped through multitasking with ease. Unfortunately, performance in PCMark 7 lagged 40% behind other convertibles using similar hardware, and closer examination revealed the hard drive as the culprit. Where many convertibles are favouring small SSDs and cloud storage, our Twist sample took an old school approach, slapping a meaty 320GB 7,200rpm mechanical drive inside instead. The option of a 128GB SSD is available for those craving extra performance at the cost of space, but it'll bump up the price.

Gaming performance was also dismal, around 20% slower than other competing convertibles using similar specs, likely caused by the mechanical drive. However, our PowerMark battery test showed that this is one of the better convertibles around, with a 168-minute lifespan under heavy load. Lenovo claims the eight-cell battery should last around 7 hours in normal usage scenarios or 30 days in sleep mode.

It might not be the sexiest product around, but as one of the most affordable convertibles, the ThinkPad Twist will be very desirable to corporate customers looking for solid performance, healthy storage and a large screen. But if you're looking for an ultraportable, super-slick convertible, the Twist probably isn't the device for you.

11.6IN 1,920 X 1,080 DISPLAY

4GB MEMORY

WINDOWS 8 64-BIT

8/10

Sony VAIO Duo 11 SVD11215CGB

Beauty is on the inside.

www.sony.com.au @

$1,459 $

Speedy performer, sturdy hinge, crystal-clear display. ✔

A little heavy, ugly hinge, poor battery life. ✖

Sony's latest convertible sacrifices good looks to deliver a much stabler touch experience. The Duo 11 uses a sliding mechanism to transform from tablet to laptop form, with the screen sliding upwards and away from the keyboard. It's quite a stiff mechanism, requiring some force, but there's nowhere to grab the sliding lid so your first few attempts will feel rather clumsy. There's a rather large benefit to this taut mechanism, though, as it holds the screen firmly in place when it's in laptop mode. This removes the bouncing seen in other convertibles when the display is touched. It's not a very pretty solution, exposing springs and hinges when upright, but it's still a much better option than a screen that acts like a trampoline every time it's used.

Sony knows a thing or two about quality displays and it's put its knowledge to work on the beautiful 1,920 x 1,080 screen used here. At 11.6in across, it's slightly larger than other tablets, but the HD resolution keeps everything crystal clear. Colour and contrast performance were also superb. Touch accuracy was impressive, even more so with the included stylus. When used in conjunction with Windows 8's solid handwriting recognition, the Duo 11 is a viable handwritten notebook alternative. When flipped out to laptop mode, the keyboard remains very thin compared to other convertibles, with no space for a touchpad. Instead, there's a tracking knob in the middle of the keyboard. It works, but only just, being markedly inferior to a standard trackpad; luckily, there's very little reason to use it.

Purring away inside is Intel's speedy Core i5-3317U, one of the better CPUs we've seen in a Windows 8 tablet of this size. It's paired with 4GB of DDR3-1600 memory and a 128GB SSD, a very healthy selection of specs at this price. This powerful collection of components saw it lead the pack in our performance benchmarks, albeit by a small margin. Twin USB 3.0 ports deliver fast external storage, while an RJ45 adapter allows for wired connection to your network – a feature missing in skinny tablets. HDMI out and a stereo minijack make this a viable media player, alongside the SD and Memory Stick Duo slots. There's even a VGA output. The included stereo speakers are barely worthy of playing the Windows chime sound effect, let alone music or movies, so you'll need to invest in a set of headphones if you plan on consuming your multimedia collection here.

The hardware combination requires good cooling, resulting in a weight of 1.3kg. It also chews through battery life, with the Duo 11 scoring a PowerMark result of a meagre 140 minutes, slightly less than the bigger 12.5in convertibles. If you're looking for a device that can handle all-day operations, you'll be pushing your luck here.

The Duo 11 is a surprisingly affordable convertible. Best of all, Sony hasn't trimmed back the hardware at this price, with powerful components and plenty of storage. The hinge locking mechanism mightn't win any beauty pageants, but it more than makes up for that with usefulness, making it one of the nicer convertibles to use in laptop mode.

INTEL WIDI

2 X USB 3.0

WINDOWS 8 64-BIT

8/10

Toshiba Satellite U920t

One of the larger convertibles with a Gorilla Glass finish.

www.mytoshiba.com.au @

$1,320 $

Excellent display, solid sliding hinge, GPS. ✔

Plastic construction, no 3G/4G connectivity. ✖

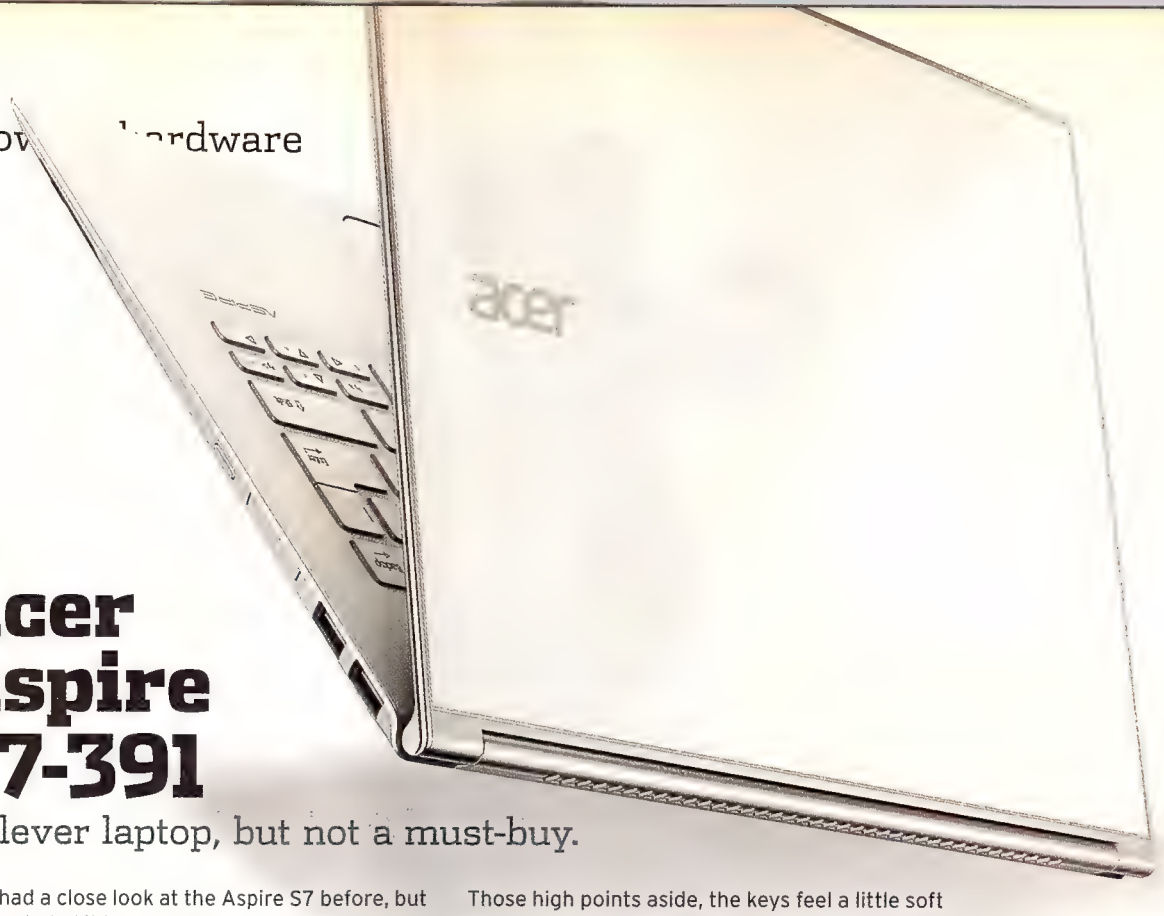
Toshiba's take on the convertible tablet/ultrabook uses a very similar sliding mechanism to Sony's Duo 11, with the screen sliding upwards and then away from the keyboard. However, it lacks the ugly brackets that keep the Duo 11's screen stable as a rock, instead relying on a very stiff hinge to keep the monitor rigid when it's upright. It's a compromise between aesthetics and functionality, but the U920t pulls it off nicely – the screen is reassuringly firm when touched and angle-adjustable, yet it looks much nicer than the complex system used on the Sony.

The 12.5in screen makes this one of the larger convertibles, using the same 1,366 x 768 resolution favoured by the budget end of town. For most users this will be fine, but designers and photographers will probably prefer the true HD resolution offered elsewhere. The Gorilla Glass finish suggests it'll handle a beating without getting bruised, while the 10-point multitouch display means the screen can be used as a virtual piano, one of the only applications that we can imagine needs so many points of contact. Despite the lower resolution, the IPS display here is one of the better ones we've seen, with excellent image quality across the board. Once again, we see a glossy finish employed and despite the anti-smudging tech provided by the Gorilla Glass, our sample was soon covered in fingerprints. If you do end up buying a touch-enabled PC, a cleaning cloth will be your first must-have accessory.

Unlike the rock-hard glass used on the display, the rest of the machine is built from plastic. It doesn't look as cheap as other plastic convertibles, thanks to the faux carbon fibre finish, but it feels thinner than the plastic found on the Lenovo Twist. The keyboard is extremely slim, with the entire unit a mere 20mm deep with the screen down, and we were pleased to see very little keyboard flex when typing. The backlit keyboard isn't quite full-sized, but it's definitely easier to use than smaller hybrid tablets, even though key travel is a little short for our liking. Compared to the lightweight 10.1in tablets, the 1.5kg weight of the U920t is rather heavy, but that's the price paid for the larger form factor.

Once again we see Intel's Core i5-3317U wheeled out to handle the heavy lifting and performance was bang on where we expected it to be, thanks to the inclusion of an SSD, which was a very healthy 256GB in size. Another 4GB of memory rounds out the solid internal specifications. Surprisingly, the bloatware that comes preinstalled on this machine – our review sample had over 10 different applications set to start every time the machine boots – didn't impact negatively on performance. Battery life was also exactly where we'd expect for a device of this size and spec, with the unit showing similar results to other 12.5in convertibles at 165 minutes. The inclusion of a GPS is a nice touch for road warriors, but you'll need to tether it to your phone, due to the lack of cellular data connectivity.

Toshiba has packed in a few added extras that help to justify the slightly higher price here, namely a large SSD and GPS. Combined with a decent screen and excellent hinge, the U920t is a rather compelling convertible.



- GORILLA GLASS COATING
- THIN BUILD
- 1080P TOUCHSCREEN

7/10

Acer Aspire S7-391

A clever laptop, but not a must-buy.

www.acer.com.au @

$1,999 $

Slim and attractive form factor, 1080p touchscreen, good performance. ✔

Only 128GB SSD, no compelling reasons to adopt touch yet. ✖

We've had a close look at the Aspire S7 before, but we've included it here as another example of what touchscreen laptops can look like. Akin to the HP Envy 4-1121TU, the Aspire S7 doesn't offer a turn/flip/slidable screen, but it can fold flat to present a keyboard-free touch interface if approached from the screen end. With the 13.1in 1080p panel being a multitouch number, it's a nice, simple solution to the laptop/tablet hybrid conundrum.

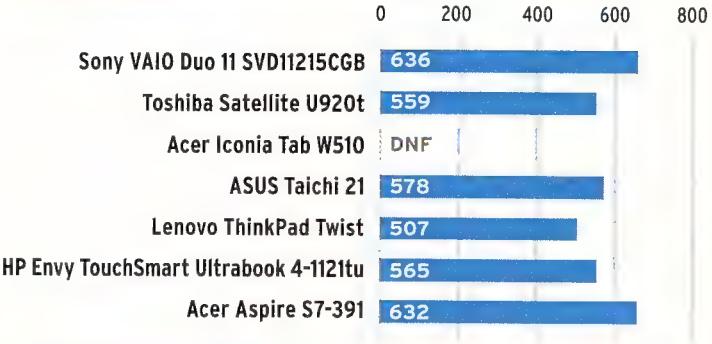
But that simplicity isn't what grabs us about the S7. It's the looks. This is a striking laptop. It has the sort of crazy thin dimensions that make us wonder just what's inside (on paper: the standard ultrabook package of Core i7 CPU, 4GB of RAM, integrated graphics and an SSD; but we suspect the S7's 12mm housing might contain something like a thin slice of flesh inscribed with sinister magic script – it's just a little too thin to believe). And as we said last month, a Gorilla Glass coating on the top half of the chassis makes it both aesthetically pleasing and potentially tough enough to double as a chopping board.

That said, Acer has gotten this laptop so thin that compromises have had to be made (perhaps Acer made sacrifices to a lower-grade deity?). General performance is on par with most high-end ultrabooks, thanks to the Ivy Bridge silicon inside, and the IPS screen offers fantastic image quality.

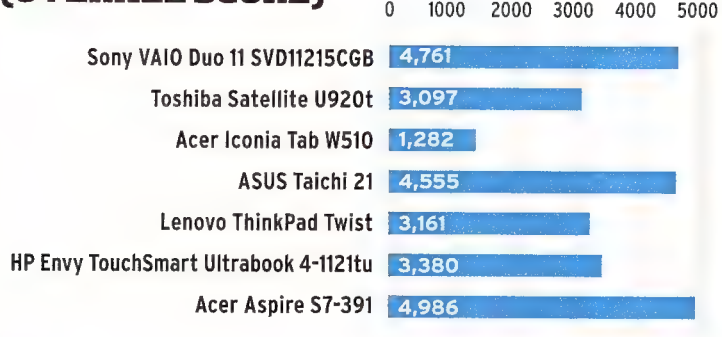
Those high points aside, the keys feel a little soft for a 'premium' laptop, which makes typing a bit of a chore, while storage is quite stingy at 128GB, especially for a laptop approaching $2,000.

All in all, there's no denying the wow factor, even taking into account the fairly traditional screen layout and finish issues. If you've got the money to burn, by all means, this laptop will turn some heads. However, as with most of the Windows 8 units here, at this stage it's more a discretionary purchase than a must-have.

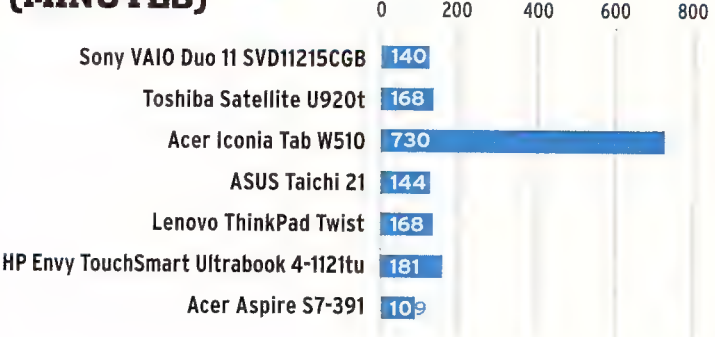
3DMARK 11 (PERFORMANCE MODE)



PCMARK 7 (OVERALL SCORE)



POWERMARK (MINUTES)



TECHlife AUSTRALIA

TECHlife
ISSUE 07 JANUARY 2013
BEST NEW TABLETS
THEY'RE FASTER, SLEEKER & CHEAPER: GOOGLE NEXUS, iPAD MINI & MORE
OUR LAB TESTING REVEALS THE TOP PERFORMERS AND BEST-VALUE BUYS
THEY CAN TAKE PUNISHMENT AND GREAT PHOTOS
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ALL-IN-ONES GO TOUCH

Windows 8 is all about touch, but does it work on a desktop PC? Lindsay Handmer tests five new all-in-ones to find out.

All-in-one PCs are a bit of a peculiar beast. Historically, they haven't had the power of a fully-fledged desktop system, nor the portability of a laptop – what you get is a thin and stylish PC that's as comfortable sitting on your desk as in common areas like the lounge room or the kitchen. And with Windows 8 and touchscreen support, all-in-ones are potentially more flexible than ever.

These days, most of us are so used to the touchscreen interfaces on our smartphones and tablets that it's almost annoying when you have to use something as pedestrian as a mouse. Built specifically with touch interaction in mind, Windows 8 provides an interface where a large-scale touchscreen can really excel. Not only are simple tasks like launching programs and changing screens easier, touch control opens up new possibilities for interaction, from gaming to early learning to artistic apps and more. When laid flat on a coffee table they're a great way to flick through photo albums or play multiplayer games with friends.

If you're considering ponying up for a Windows 8 all-in-one, there are some key factors to look out for. Many models use the mobile versions of CPUs and while they're fine for general-purpose computing, they lack the grunt for more intensive work. You'll also have to consider the size of the machine and where you want it to live – 23in is perfect for sitting on a kitchen countertop, but if you want the PC to do double duty for entertainment purposes, 27in models are a surprisingly affordable upgrade. It's also worth noting that while a touchscreen does bring about new gaming possibilities, all-in-one units mostly lack high-end GPUs, so more hardcore gaming might be a stretch.

Many all-in-ones do have other entertainment options such as HDMI inputs, Blu-ray drives, remote controls and TV tuners. This makes them an ideal device if you've got limited space, as the PC can handle a range of entertainment needs.

While it can't lie flat, HP's Envy 23 TouchSmart can be tilted back for upright use.

7/10 Acer Aspire 7600U

What is this? A touchscreen all-in-one for giants?

@ www.acer.com.au $ $2,299

✔ Big 27in screen, built-in TV tuner and Blu-ray playback.

✖ Uses a mobile CPU, reflective screen, a bit pricey.

If you're after a monster all-in-one PC, then the 27in Acer is just the machine. Sure, at $2,299 it's a tad expensive, but the minimalist design is very polished – ports are well located and the power plug goes right into the stand. The large screen has a 1,920 x 1,080-pixel resolution and is vibrant and bright, though the glossy coating does create a lot of reflections. The Acer has a 2.53GHz Core i5-3210M CPU (that's technically a laptop chip) and 8GB of RAM. The Nvidia GeForce GT 640M graphics chip is likewise a mobile part and while it's better than an integrated GPU, it's underpowered if you want to do anything but the lightest of gaming. The Acer also comes with a built-in TV tuner,

8/10 Dell XPS One 27 (Touch)

Build quality like no other.

@ www.dell.com.au $ $2,199

✔ 2,560 x 1,440 resolution 27in screen, Core i7 CPU, no power brick required.

✖ Almost too large, pricey, some glare problems with screen.

Dell's XPS One 27 is another all-in-one to use a massive 27in screen, and this is even more impressive than Acer's. It's powered by an Intel Core i7-3770S CPU buzzing along at 3.1GHz and has 8GB of DDR3 RAM. The Nvidia GeForce GT 640M GPU is again nothing particularly special, but it's mildly faster for basic gaming than the Acer. You also get a 2TB hard drive combined with a 32GB mSATA cache drive, Blu-ray combo drive, plus a quality wireless keyboard and mouse. The XPS One 27 has six USB ports (two USB 3.0) as well as LAN, memory card reader and webcam. It also has built-in 802.11n Wi-Fi. The speakers are surprisingly good and you can

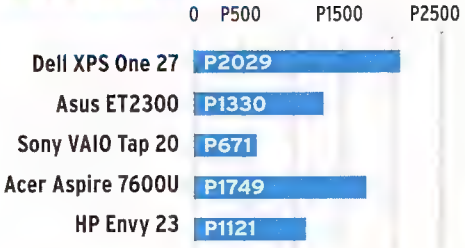
- DUAL HDMI INPUTS
- WEBCAM GESTURE CONTROL
- WIRELESS KEYBOARD & MOUSE

Blu-ray drive and remote control that make it a surprisingly good media PC. You can even plug external video devices (such as a gaming console) in via dual HDMI inputs. You also get a 1TB hard drive, a card reader and four USB ports (two of which are USB 3.0). In our benchmarks the Acer performed well, though the slower CPU put it behind similarly spec'd competitors such as the Dell XPS One. The touchscreen itself is very responsive and we had no problems navigating Windows, though it does become smudged fairly quickly with fingerprints – these aren't too noticeable in normal use, thankfully. Those with short arms might struggle with the large screen size. The stand allows you to lay the unit down on your desk for a more tablet-like experience. The Acer also includes software that allows you to control it via the webcam and hand gestures (for normal operation, the included wireless keyboard and mouse do perform admirably). If you don't have the desk space for such a large PC, Acer also has the smaller 23in Aspire 5600U starting at around $1,399.

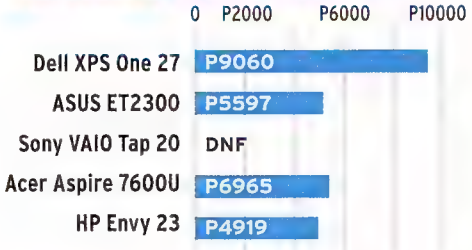
- BLU-RAY DRIVE
- EXCELLENT STAND
- WIRELESS KEYBOARD & MOUSE

feed video and audio in from other sources via HDMI. The Dell also does away with the power brick, instead moving the PSU inside the computer itself. The massive screen runs at 2,560 x 1,440 and has a glossy surface, which while nice on the fingers, does reflect a lot of light. On the plus side, the screen itself has wide viewing angles, very accurate colour reproduction and excellent brightness. The touchscreen is excellent and we only had a few minor issues navigating Windows due to the large screen size. As we expect from Dell, the stand is amazing. Not only is it very smooth and easy to use, it gives an excellent array of angles to ensure you get the best touchscreen or mouse/keyboard experience. If you just want the Windows 8 experience without all the touchscreen tomfoolery, the XPS One 27 is also available in a non-touch model.

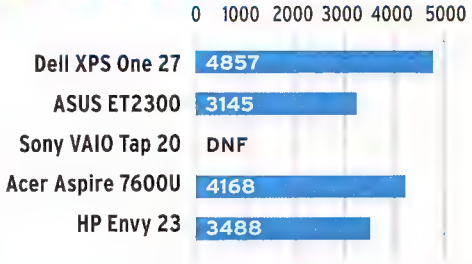
3DMARK11



3DMARK VANTAGE



PC MARK 7



DIRT 3 (AVERAGE FPS)

DNF: Did not finish test.

6/10

ASUS ET2300

A solid AIO PC.

@ www.asus.com.au $ $1,999

✔ IPS screen, great audio, Wi-Fi.

✖ Slow CPU, weak GPU, no TV tuner.

COMPONENTS IN BASE FOR STABILITY

WIRELESS KEYBOARD & MOUSE

UPCOMING CORE I7 MODEL

Inside the stylish ET2300 is an Intel Core i5-3300, 8GB of DDR3 RAM, an Nvidia GeForce GT 630M GPU with 1GB of RAM and a 1TB hard drive. The ASUS also includes six USB ports, HDMI in and out, a DVD drive and built-in wireless. It runs Windows 8 64-bit and doesn't include a remote or TV tuner. The ASUS is excellent to use, with great response from the 10-point touchscreen, although the GT 630M graphics chip only provides marginal gaming performance – older titles are fine, but newer games will need the graphics dialled back to medium or low settings if you want a decent frame rate. The ASUS claims to have the best audio ever on an all-in-one and while we're not sure if that's quite true (having not tested every all-in-one ever made), it's certainly good. The 23in, 1,920 x 1,080 IPS screen is vibrant (yet quite glossy), though it has quite a bit of noticeable light bleed in dark scenes. The mount lets you lay the screen flat for a more tablet-like Windows 8 experience. The ET2300 also puts most of the hardware inside the base and while this makes it a lot chunkier, it means the PC is very stable to use. It also includes a wireless keyboard and mouse, but annoyingly, these use a USB receiver, which takes up one of your precious ports. If you're after a cheaper model, you can get the ET2300 with less RAM, no discrete GPU and a Core i3 CPU. For just $200 more, however, you can get the 27in model with faster a CPU and GPU, plus a bigger hard drive. (We're told this 23in model will get a bump to a Core i7 CPU in early 2013, which should produce a slight performance increase).

NOT RATED

Sony VAIO Tap 20

Shows promise, but our early test unit was flaky.

@ www.sony.com.au $ $1,499

✔ Doubles as a big tablet thanks to in-built battery, great screen.

✖ Expensive, screen not 1080p, basic GPU.

20IN TABLET EXPERIENCE

4 HOUR+ RUNTIME

SLIM WIRELESS KEYBOARD & MOUSE

Touchscreen all-in-one PCs running Windows 8 are already very tablet-like, but Sony takes this idea a step further with the VAIO Tap 20. With a 20in screen and 5kg weight, it's not a unit you can toss around or slip into a small bag. Despite those physical characteristics, it actually feels very natural to use on your lap. It also has an inbuilt battery, which with normal use managed a bit over 4 hours of runtime. If you're using the Tap 20 on a table, the stand means you can use it as a normal PC or at just about any angle, right down to lying flat. The Tap 20 runs a 1.7GHz Core i5-3317U CPU, has 4GB of RAM and a 750GB hard drive. The screen runs at a slightly rarer 1,600 x 900 resolution, which we found isn't quite high enough up close and left us with a pixelated taste in our mouth. The colour reproduction and viewing angles are excellent, though we found the screen just isn't bright enough for use in outdoor locations – a situation that most tablets or laptops can handle. You can use Windows 8 via touch and an onscreen keyboard, but the Tap 20 also comes with a slim wireless keyboard and mouse. It's not bad as a media playback machine, with surprisingly good audio considering the slim form factor, although don't expect anything but basic gaming from the Intel HD 4000 GPU. It's a struggle to find the Tap 20 under the $1,499 retail price and unless you really want the Windows 8 tablet experience, that leaves the Tap 20 a tad overpriced. Our pre-production unit had quite a few stability issues and couldn't run our entire array of benchmarks. Sony promises the final retail units are flawless, so we've held back from scoring this one until we can get our hands on one of those.

5/10 HP Envy 23 TouchSmart

Underwhelming performance and a little overpriced.

@ www.hp.com.au $ $2,299

✔ High system specs, 2TB hard drive, 1080p screen.

✖ Comparatively poor performance, junk software included, expensive.

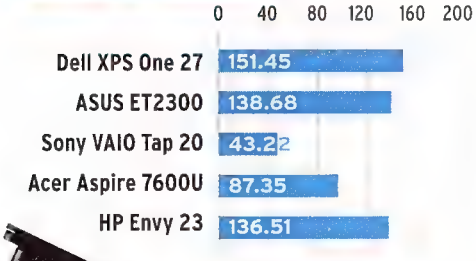
BEATS AUDIO SYSTEM

BLU-RAY COMBO DRIVE

TV TUNER

On paper, the high-spec Envy 23 gets a lot right, packing a Core i7-3770S CPU, 16GB of DDR3 RAM and a GeForce GT 630M GPU with 2GB of memory. It's also got a 2TB 7,200rpm hard drive, Gigabit LAN, built-in wireless, memory card reader and six USB ports. For your media needs, it also has a Blu-ray combo drive, digital TV tuner and Beats audio system. The 23in screen runs at 1,920 x 1,080-pixel resolution and has nice, bright colours and wide viewing angles. Like any glossy display, reflections are a problem, although the glass surface is great for touchscreen use. It uses 10-point multitouch, which, like its competitors, is very accurate and easy to use. The stand allows the Envy 23 to be tilted back for easier use, but it can't lie flat. In use, it struggled in our benchmarks, despite its high specs. The GeForce GT 630M GPU is definitely a letdown if you're a gamer – there's little power here, meaning you'll need to drop the detail levels down to medium or lower. Audio quality is acceptable for watching movies, gaming or TV; however it doesn't really have a wide enough range for music playback. You do get an HDMI input, though, so you can use your console or other media device through the HP's screen. As expected, the Envy ships with a solid wireless keyboard and mouse as an alternative to the touchscreen. It runs Windows 8 64-bit and it came with quite a bit of excess junk software installed, such as Norton Internet Security. If the $2,299 retail price is a little hard to swallow, you can get a lower-spec version for as little as $1,299 or even down size to the 20in model. APC

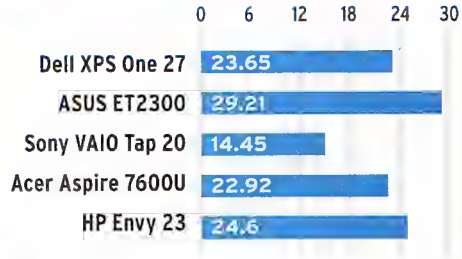
X264 PASS 1



X264 PASS 2

CINEBENCH CPU (POINTS)

CINEBENCH OPENGL (FPS)



The Acer Aspire 7600U has a huge adjustable screen.

CRANK UP THE AC!

The next iteration of Wi-Fi has arrived. Nathan Taylor tests seven 802.11ac devices to see which ones are worth your dosh.

Wi-Fi is about to get a shot in the arm. Over the course of 2013, you'll be seeing more and more networking devices using the new 802.11ac wireless standard. This new iteration of Wi-Fi, which will eventually replace 802.11n as the dominant standard, more than doubles the speed. In some circumstances, it might even be faster than a wired Gigabit Ethernet connection.

FIVE THINGS TO KNOW ABOUT 802.11AC

01 It's fast. The initial products released for 802.11ac come in two speeds: 867Mbps and 1300Mbps. That's compared to the 450Mbps that 802.11n currently supports. As we found in our tests, 1300Mbps at relatively close range can actually be roughly as good as a wired Gigabit Ethernet link.

In the future, 802.11ac can theoretically go up to speeds of 6.93Gbps and beyond, but that's not likely to happen for a few years yet.

02 It's only for the 5GHz band. That's right, 802.11ac *only* works in the 5GHz frequency band. There's no 2.4GHz version of it. Historically, most wireless devices have operated in the 2.4GHz band.

That being said, all the routers and access points released so far include support for 802.11n in the 2.4GHz band, so your legacy devices (and by 'legacy' we mean the vast majority of existing Wi-Fi devices) can still use them. As a result, expect to see routers and access point with wireless speeds advertised something like this: 300/1,300Mbps. That means they support 300Mbps 802.11n in the 2.4GHz band for older devices and full 1,300Mbps 802.11ac in the 5GHz band.

03 It's backwards compatible. An 802.11n device can absolutely talk to an 802.11ac access point – on the proviso that the device supports the 5GHz band, though see the point above, as most 802.11ac routers also support dual-band, but can only operate at 802.11n speeds in the 2.4GHz band.

Of course, an 802.11n wireless device can only talk to a router at wireless n speeds, so there will be no special benefit to using these devices with an 802.11ac router. But they'll be compatible.

04 Mobile devices will have lower speeds. That's actually true today with 802.11n and it will continue to be true with 802.11ac. Like 802.11n, 802.11ac achieves high speeds using multiple antennas, multiple radio

bands and complex encoding. To save power, mobile devices tend to have a stripped-down implementation: typically, a single antenna and a single band.

As a result, when they appear, mobile 802.11ac devices may be limited in speed. We don't yet know what the typical speed will be. For example, today mobile 802.11n implementations are often limited to 72Mbps or 150Mbps. 802.11ac mobiles may have a top speed of 200Mbps or less, though 433Mbps is theoretically possible with a single antenna.

05 It's still a draft standard (but don't let that stop you). Technically, 802.11ac is still a draft standard and full ratification won't happen until later in the new year. The gears of the IEEE grind slowly.

However, the implementation is more or less settled, and any minor changes that might come up can be fixed with a software patch. In short, there's almost no danger of a router you buy today being made obsolete when the standard is ratified.

That being said, the products we looked at here did give us some concern. While the Netgear and Linksys devices all interoperated beautifully, the Belkin and ASUS routers didn't want to play nice with their counterparts, with problems detecting the networks and sub-par performance when they did connect. As a result, we'd be wary of mixing and matching vendors until the final standard is ratified.

TALKIN' TECH

To understand what's changed with 802.11ac, you really have to go back to the innovations that appeared in 802.11n. The big advancements we saw in 802.11n were multi-channel usage, improved encoding and MIMO (Multiple Input Multiple Output).

The first one is easy to understand. The radio spectrum available for Wi-Fi communication is divided into 20MHz channels. Prior to 802.11n, a single device was only permitted to use a single channel; with 802.11n, a device could use two channels at once, doubling the throughput.

MIMO is more complex. It allows a wireless transmitter to use multiple physically separated antennas to send multiple streams in the same frequency band, using spatial division to keep the streams separate.

The number of antennas determines the number of spatial streams available, and different encoding methods also support different data rates. As a result, we ended up with a number of permutations of 802.11n: single spatial stream on a 20MHz channel (72Mbps, commonly seen in mobiles), single spatial stream on a 40MHz channel (150Mbps), dual spatial streams on a 40MHz channel (300Mbps), and triple spatial streams on a 40MHz channel (450Mbps).

Simply put, 802.11ac is 802.11n cranked up to the next level. Where 802.11n supported up to four spatial streams, though we never saw more than three implemented, 802.11ac supports up to eight. Where 802.11n was limited to 40MHz channels, 802.11ac allows 80 and even 160MHz channels. Modulation encoding has also been upgraded, from 64-QAM to 256-QAM, to use the technical terms.

As with 802.11n, we're going to see multiple permutations, depending on the capabilities of the access point or router. Indeed, we already have: 867 and 1,300Mbps devices are available right now. The 867Mbps devices use two spatial streams and 80MHz channels, while the 1,300Mbps devices use three. In the future, we'll likely see devices that support four spatial streams (1,733Mbps) and possibly 160MHz channels for a total of 3,466Mbps. Technically, the specification goes even further – with eight spatial streams, we could hit 6.93Gbps.

IN PRACTICE

There's no question from our test results: 802.11ac is the real deal. We tested each of the devices here at three different ranges and at the shortest range (5m), we actually wondered whether the limiting factor was the wireless link or the Gigabit Ethernet bridge between the router and server. That's to say, it transferred data fast enough to saturate a Gigabit Ethernet link in practice. Our top test speed was over 507Mbps (63.4MB/s), which is as fast as you're likely to see Gigabit Ethernet go.

So how does this compare to 802.11n? To find out, we retested the Linksys EA6500 in the same setup as for 802.11ac, but this time the wireless network was set to 802.11n only. Everything else, including the use of the Linksys WUMC710 as a client, was identical. With 802.11n, data transferred at 28.6MB/s at 5m, 23.3MB/s at 10m and 15.2MB/s at 15m. Respectively, that's 45.1%, 53.9% and 48.5% of the 802.11ac speeds.

ROUTERS

We managed to get hold of five early-release routers and all but one are standard broadband routers, lacking a modem of any kind. All are NBN-ready.

ASUS RT-AC66U

Great features, but disappointing performance.

@ www.asus.com.au

✓ Lots of features, including advanced options like VPNs.

✗ Significant performance issues in our tests.

On paper, the RT-AC66U looks close to being the ideal router. Supporting full 1,300Mbps 802.11ac wireless as well as 450Mbps 802.11n in the 2.4GHz band, its wireless performance is theoretically as fast as they come. On top of that, it comes with a host of great features: twin USB ports for file and printer sharing, Gigabit Ethernet ports, cloud storage tools and excellent Quality of Service (QoS) management.

Unfortunately, when it came to performance, it didn't live up to the promise. It made us actually wonder if there were indeed compatibility issues to be resolved with these draft products. The Linksys WUMC710 station we were using for our testing couldn't even see the SSID of the RT-AC66U unless all security was switched off, and when we did manage to connect it, the performance was dismal relative to its competitors. We even had to check that it was connecting at 802.11ac rates (it was).

Worrying that there might be a compatibility issue between the Linksys client and the ASUS access point, we then tried connecting with the Netgear A6200 USB adapter. The results were worse, at 21.2MB/s at 10m. Finally, we tried bridging two ASUS RT-AC66U routers (making one router the access point and one the client station) and testing the performance – the result was better, but not by much. Two ASUS routers bridged produced a speed of 30.9MB/s at 10m. Clearly, ASUS has some work to do to get its implementation up to scratch.

It's a shame, too, because the interface is excellent. It's a little more hardcore than we saw with the Linksys and Netgear routers, but if you're a tinkerer it's got the goods. It even lets you set advanced elements like transmit power, VPNs and traffic management. Quite simply, it has more tools built in than any of its competitors. It seems ASUS just has to get the performance right.

6/10

$280

Belkin AC 1200 DB

An attractive router, but has it got the goods inside?

@ www.belkin.com/au

✓ Looks great.

✗ Poor performance, even for a device limited to 867Mbps.

Belkin was one of the first companies out the gate with an 802.11ac product, releasing the AC 1200 DB back in August. It's a router with dual-band wireless networking, but unlike the other routers here, all of which support 1,300Mbps 802.11ac, it only supports 867Mbps.

Predictably, that resulted in test speeds that were considerably lower than the competition, even the poorly performing ASUS. It also had similar compatibility issues as the ASUS: the Linksys station we used for testing initially didn't even want to acknowledge its existence. While the Netgear wireless adapter connected fine, its transfer rates were still significantly lower than they should have been, barely hitting 16MB/s at 10m.

We were also a little disappointed with the management interface. Where other router vendors have continually improved their management interface to make them more accessible to consumers, Belkin seems to have gone the other way. Its management interface is more technical than we've previously seen in Belkin devices, with a wall of technical options and specs greeting anybody who logs onto the router's web interface. Thankfully, most people can avoid these by using the setup wizard.

There are a lot of great features buried here, however, including some fine traffic management and QoS features, as well as DNS-based parental controls – an increasingly common feature in consumer routers. These parental controls use a third-party DNS server (in this case, Symantec's) that won't resolve the addresses of sites with unwelcome content. This means it'll filter out sites with objectionable content.

The router also boasts two USB ports with excellent file-sharing features (including full support for DLNA) along with the now-familiar Belkin art deco styling that sure looks better than the monotone blobs that are most routers.

9/10

$280

Linksys EA6500

Crazy fast and highly capable.

@ www.linksys.com.au

✓ Crazy fast, sleek but friendly management interface.

✗ It ain't cheap.

Maybe it was because of a vendor advantage, with the client station we used for testing also from Linksys, but the EA6500 blew through our tests faster than any other router we looked at. At its top speeds it was rivalling Gigabit Ethernet for data rates and that's something we never really thought might happen.

But pure speed isn't the only thing the Linksys has going for it. Like Netgear, Linksys has made considerable strides with respect to making the router easier for non-technical people to manage. Setup is managed by a plain English wizard and even highly technical elements like QoS have been simplified enough to be accessible to everyone. We particularly like the guest access system, which creates a virtual wireless network that guests can use; it gives them access to the internet, but not to your private computers and servers. To please parents who want to limit the amount of time their kids spend surfing the net, there are also parental controls which specify at which certain times a given computer can access the internet.

As has become common, the router boasts two USB ports, capable of sharing files using Windows File Sharing (Server Message Block), FTP or DLNA. We tested the DLNA service with an Xbox 360 and PlayStation 3, and both worked flawlessly. It even worked with a notoriously fickle Samsung television.

Like all current 802.11ac routers, however, the speed of the router comes at a fairly steep price. With a street price of around $300, the Linksys isn't quite as expensive as the Netgear routers (the Netgear D6300 reviewed on the next page is closer to $350), but it's still going to set you back much more than most equivalent 802.11n routers. No doubt this will change throughout the course of the year, but as always, being an early adopter is expensive.

Netgear D6300

Superfast, and ADSL and NBN-ready. What more do you need?

@ www.netgear.com.au

✓ ADSL is built in, great firmware and associated apps.

✗ That price tag.

The sole ADSL router we were able to acquire for this feature, the D6300 is perfect for those who have ADSL2+, but want to be ready when the National Broadband Network (NBN) fibre comes along. As has become the trend in new ADSL routers, it includes both an ADSL2+ port and a Gigabit WAN port, ready to be switched over to the NBN when it finally comes your way.

The D6300 supports full 1,300Mbps 802.11ac and 300Mbps 802.11n in both the 2.4GHz and 5GHz bands. We tested the former performance and it was very impressive – not quite as quick as the Linksys EA6500, but not far off the pace, either. As expected, its results were extremely similar to the R6300, which isn't surprising given the many similarities between the routers.

As an added bonus with the D6300, you get two USB ports for sharing files and printers, and one of the best-designed router interfaces we've encountered. It supports full DLNA sharing, and very solid parental controls and bandwidth management. We tested the DLNA function with both an Xbox 360 and PlayStation 3, and both worked flawlessly. We also tried out the Netgear Genie app for Android (also available for iOS), which lets you manage your router from a mobile phone. Although it didn't provide quite the level of control we'd have liked, it still gave us easy access to the most important features of the router, which is a plus.

As an added bonus, the D6300 also comes with ReadySHARE Cloud, a web service from Netgear that lets you access the contents of attached files over the internet. It's not a true cloud service – you're not uploading to an online hard drive, you are just getting remote access to your own drives – but it's a useful, free and easy way to get access to your files from anywhere. And we'd all agree that this is a very handy thing to be able to do.

Netgear R6300

A speedy broadband router with excellent firmware.

@ www.netgear.com.au

✓ Great firmware and features, fast.

✗ Yet another 802.11ac router that's just too expensive.

At first glance, it's hard to tell the difference between the Netgear D6300 and R6300. They both have the same oversized chassis with glowy Netgear logo, very similar firmware, twin USB ports, wired Gigabit Ethernet ports and support for 1,300Mbps 802.11ac. But there are differences; most notably, the R6300 doesn't have an ADSL port and is therefore only really useful for fibre and cable users.

But there are other subtle differences as well. For example, the R6300 supports 450Mbps 802.11n in both the 2.4GHz and 5GHz bands, whereas the D6300 supports only 300Mbps 802.11n. That's a significant factor for now, since it will be some time before 802.11ac becomes ubiquitous.

As we noted with the D6300, Netgear has the best firmware going in our view. It has stripped away much of the technical jargon that plagued earlier router models and has made something that's not terrifying for the layman to manage. There are some things it still could do better – like explaining what the different wireless security options are – but it's a step up from many of its competitors. Like the D6300, the R6300 can be fully managed through the Netgear Genie app for Windows, Mac, iOS and Android. It provides a simple touchscreen interface to major router features, including traffic management and parental controls.

It also has great consumer features built in, like DLNA and SMB file sharing from attached hard drives, as well as easy printer sharing. There are honest to goodness categorised parental controls (not just user time limits, but actual site filters), great mobile apps for router management and even cloud services for secure remote access to shared files.

It didn't quite have the performance of the Linksys in our tests, but we give this Netgear the edge when it comes to features.

ADAPTERS & BRIDGES

While we've reviewed mostly routers here, 802.11ac networking is so new that you'll likely need an adapter or wireless bridge to use it. Here are a couple of options.

Linksys WUMC710

A media connector and bridge from wired to 802.11ac wireless.

@ www.linksys.com.au

✓ Extremely fast, four Gigabit ports.

✗ Requires mains power, doesn't work with 2.4GHz.

Releasing a simple bridge for 802.11ac was a very clever move by Linksys. The WUMC710 is a box approximately the size of a small router, with four Gigabit Ethernet ports on the back. Its sole function is to take data from an 802.11ac router and put it on to the Gigabit Ethernet links, and vice versa. It allows you to effectively connect wired devices (like gaming consoles, TV sets and other AV equipment) to an 802.11ac network.

With its four ports, up to four wired devices can be hooked up to the wireless network. It's even useful for devices that already have wireless built in; after all, very few devices have 802.11ac support right now, seeing as it's such a new standard.

It's very fast, too, even for networks that are only 802.11n. In addition to substantially outperforming the Netgear A6200 adapter (see our next review) in terms of 802.11ac performance, it absolutely lapped our laptop's integrated Intel Centrino Wireless-N 1030 adapter. At 10m, the Intel adapter was transmitting data at 8.1MB/s on an 802.11n network, while at the same range on the same network the WUMC710 achieved 23.3MB/s, which impressed us.

It's not without its downsides, of course. Notably, it only supports 5GHz operation – it can't even see networks in the 2.4GHz spectrum. It can also be a pain to set up. Once it got an IP address from the router using DHCP, we had to go through hoops to find and log into the web administration console again. The manual was of very little help and there's no simple software management tool to help out like Linksys has for its routers.

Still, it's extremely fast and a very easy way to get up to four devices connected to your new 802.11ac network. It's perhaps not as convenient as a USB adapter and requires mains power, but if you've got fixed devices that you want to give top speed to, it's a great deal.

Netgear A6200

Easily adds 802.11ac support to your laptop or desktop.

@ www.netgear.com.au

✓ It's actually available, simple setup.

✗ Only supports the slower 802.11ac standard, USB 2.0 not USB 3.0.

As is typical when a new wireless networking standard comes out, finding an adapter that supports it is like finding a unicorn. It took forever, for example, for 450Mbps adapters to become widely available.

Fortunately, there's at least one USB 802.11ac adapter on the market: the Netgear A6200. A chunky grey USB stick, it can plug either directly into the side of a laptop or, if better antenna positioning is needed, it can slot into a small stand attached to a flexible cable. The stand is an added boon for those with computers that have tightly packed USB ports – the A6200 is so fat that it will likely crowd out nearby USB ports if plugged directly into a PC.

Like the Belkin router, the A6200 only supports the slower of the initial 802.11ac standards, peaking at a speed of 867Mbps. It's actually less than that in reality, since the device is unaccountably USB 2.0 and the peak throughput of USB 2.0 is 480Mbps.

Of course, wireless performance rarely even approaches peak speeds and in practice, it's the wireless networking that will be the limiting factor. So it was in our testing, where speeds were insufficient to push the limits of USB 2.0. At 10m it transferred data at 16.6MB/s to the Linksys EA6500 on an 802.11ac network. At 5m that increased to 22MB/s and at 15m, dropped to 9.1MB/s. When we switched the network over to 802.11n, it hit 9.2MB/s at 10m in the 2.4GHz band.

These test results were substantially slower than the Linksys WUMC710, but that's not entirely unexpected, given that the Linksys supports full 1,300Mbps and contains considerably more internal space for an antenna.

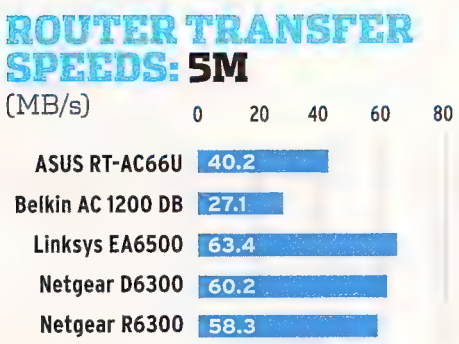
Thankfully, Netgear isn't trying to squeeze early adopters too much when it comes to pricing. Sure, it's considerably more expensive than an 802.11n adapter, but it's not so expensive that you'll go broke trying to equip your home computers with 802.11ac.

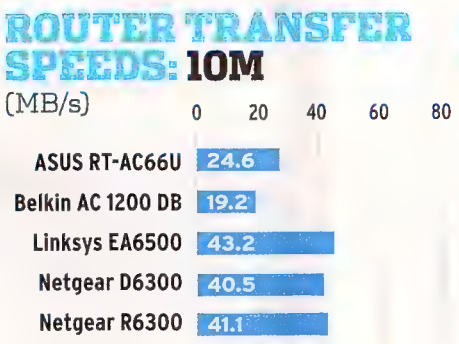
HOW WE TESTED

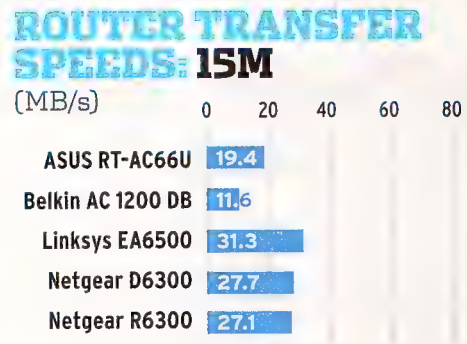
We always dread wireless testing. There are a million variables that come into play with wireless and any one of them can produce performance spikes or drag overall performance down. For this roundup we finally decided to set aside things like signal strength and signal-to-noise ratios and settled on a 'proof is in the pudding' test: file copy speeds.

For each router we performed file copy tests from a RAM drive on a high-speed server. A 2GB file was copied three times at a range of 5m from the router and the transfer rate averaged. We then moved back to 10m (with one intervening wall) and repeated the test, and again at 15m through two intervening walls. The test results show the average transfer rates at those three ranges in megabytes per second (MB/s); in all cases, the higher the better.

All the test results were achieved using the Linksys WUMC710 as the client station device. It was the only device we could acquire that supported full 1,300Mbps speeds. We also performed backup tests with the Netgear A6200 USB adapter in case of specific incompatibilities with the Linksys – its results were lower than that of the Linksys, but consistent on a relative basis.







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Windows 8 Store

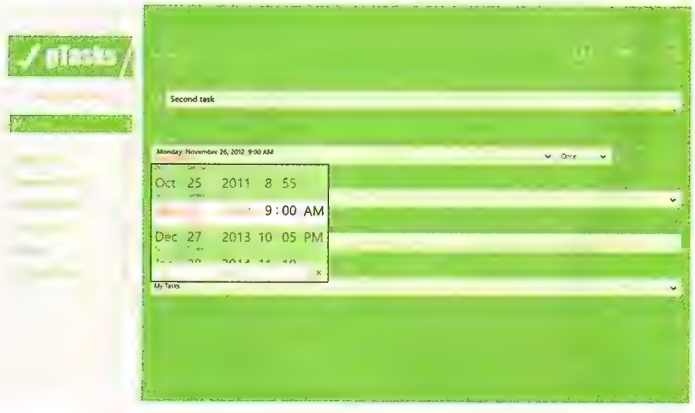
WINDOWS 8 APPS

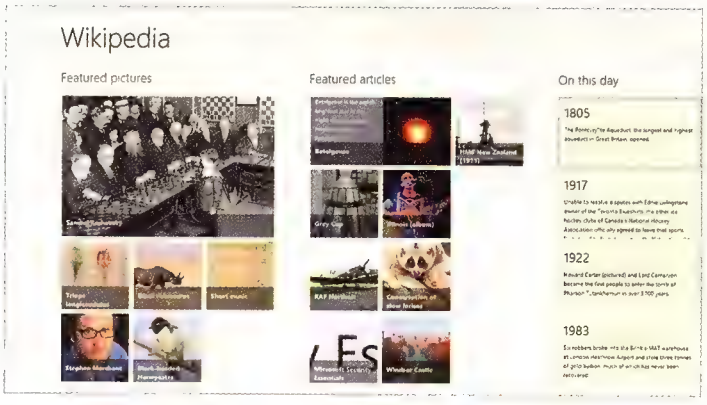
The Windows Store now has up to 20,000 apps. Here are some of the better ones.

gTasks HD

$4.49 | Yaniv Katan | tinyurl.com/ck2qde6

One of the biggest disappointments with Windows 8's built-in calendar and to-do apps is that they're rather lame compared to the versions in the real desktop Outlook. The to-do list in particular looks almost like an afterthought and while it syncs well across all Windows 8 devices and Windows Phone 8 handsets, it's just too limited to be of any serious use. As a result, many are forced to use the Gmail to-do app. It lets you organise your task list, but its killer feature is that it works with dozens of third-party apps on iOS and Android devices. The best third-party app for Gmail's to-do list is gTasks. The developer has done superb versions for iOS and Android, and has now created a version for Windows 8. Once you get used to the Modern UI interface, it's quite powerful, featuring task alerts and repeating tasks, multilevel sub-tasking and customisable task views. It's easily the best task manager on Windows 8. Now if only Microsoft could release a better native to-do app.





Wikipedia

Free | Wikipedia | tinyurl.com/blhx7do

It's great that Wikipedia now has a Windows 8 app, since it helps the Windows Store get its numbers up, but the lameness of the Wikipedia web UI is now replicated in the app version as well. We'd say that least 99% of visitors to Wikipedia are searching for something rather than wanting to browse the service, yet on the web site home page the search box is barely visible in the top-right corner, with the main space devoted to obscurities such as the fact that the Pontcysyllte Aqueduct (the longest and highest aqueduct in Great Britain) opened in 1805. So we fire up the Windows 8 Wikipedia app and there's no search box at all in the opening screen, but more 'featured articles' and 'featured pictures' and links to recently featured pages. The app instead uses the integrated Windows search, which means you have to slide the mouse to the right, drag it down, open the Charms bar, and *then* click on system search (shake of the head). Benefits of the app? You can pin articles to read later or share them with other articles. Hardly worth the effort.

Piano Time

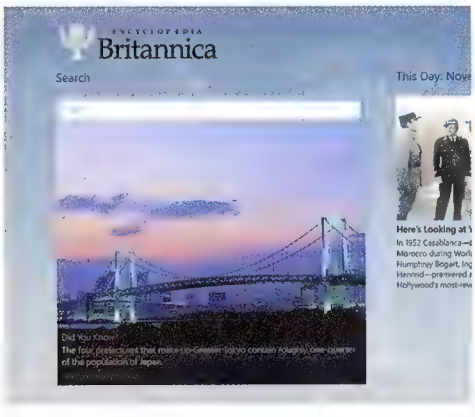
Free (ad supported) & $ 2.99 (no ads) | Revel Software | tinyurl.com/cxbnat8

Piano music apps have proved very popular on the iPad and they're coming over to Windows 8. We looked at several in the Windows Store and came to the conclusion that this one is the best. Piano Time (ad-supported) or Piano Time Pro (no ads), consists of 36 visible keys and four selectable octaves. You can use either to have fun, recording and playing back tunes, or for learning some of the fundamentals of playing a piano, using its configurable metronome. The Piano Time apps support multitouch screen, keyboard and mouse input.

Encyclopaedia Britannica

$14.99 a year | Encyclopaedia Britannica Inc. | tinyurl.com/cavbfkq

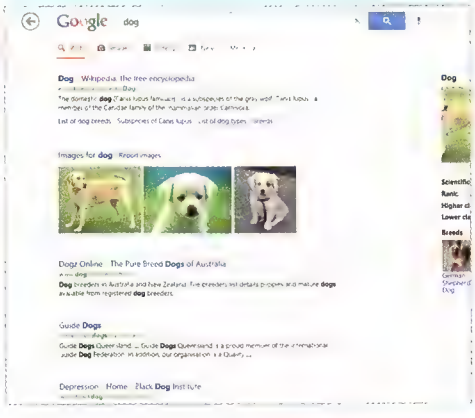
Like many traditional media companies, Britannica has had to migrate from its original medium and is replicating itself on any new media platform. You can see the professional media heritage in the Windows 8 app, from the slickness and usability of the interface and search results, to the polished content curated by knowledgeable professionals. There's also a search field right there on the main screen (no having to rely on Windows' integrated system search). There's a free version of the Britannica app that's quite useless, or the full version, with unlimited content costing $14.99.



Google Search

Free | Google | tinyurl.com/bplx6bj

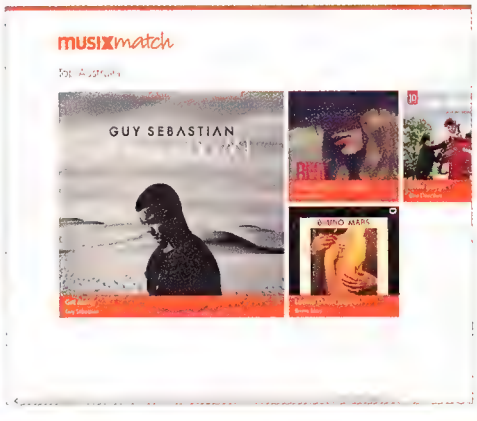
Installing the Google Search app on Windows 8 is like finding yourself in Chalmun's Cantina on Tatooine surrounded by weird intergalactic characters who act and talk in strange ways (Modern UI) and unexpectedly bumping into a close friend like Han Solo (Google Search app). You just feel utter relief. The Google Search app on Windows 8 is brilliant. There's a bix search box on the app's main page (you can use the integrated system search, too) and it neatly uses the right side of the screen for its knowledge graphs. It has all the goodies, from voice and image search to instant preview mode. By swiping from the top, you can see your recently visited sites.



musiXmatch Lyrics

Free | musiXmatch | tinyurl.com/c9as6df

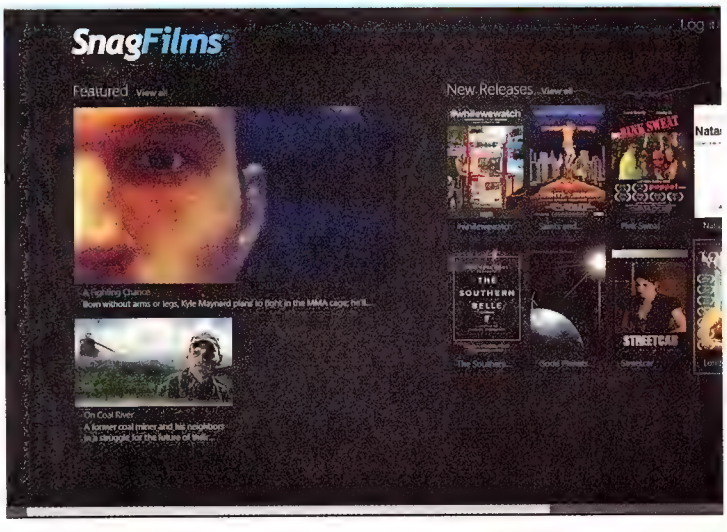
One of the best things about the Windows Store is that you're now getting more software that works across multiple devices. More and more software that's available on iOS or Android is going to be finding its way to Windows and onto your Windows tablets, laptops, hybrids or PCs. One such example is this musiXmatch Lyrics app. With lyrics from 5.5 million songs, it's available on iPhone, iPad and Android, and now you can have it on Windows 8. With a fully integrated music player and song tracker, it will play the songs from within the app as well.



SnagFilms

Free | SnagFilms Inc. | tinyurl.com/c9rwh6m

One thing Windows 8 has to do well on tablets is entertainment, so it's good to see another (originally) iPad video app available here. SnagFilms is a great collection of B-grade and C-grade movies, shorts and docos. As with all free movie sites, there's plenty of dross, but also some gems. A quick look at the movies in the app reveals plenty we could bear to watch on our Windows 8 devices, from the movie *For the Love of Benji* (with the kids!) to a Guns 'n' Roses doco (150 minutes of footage of the band). The categories are those of your video store, from 'Drama' to 'Family' to 'Nature'. While there are plenty of fan-based movie apps in the Windows Store, few actually play movies. Apps like SnagFilms are important because they highlight the slow transformation of Windows as an OS for productivity to one for entertainment, at least on tablets. It surely won't be long before apps like Sony Crackle, which has many first-rate movies for free on iOS and Android, start showing up on Windows 8.



App Store | IOS APPS

Terra Noctis

The most adorable nightmare undertakes a quest to become terrifying.

99c | Bulkypix | tinyurl.com/bka7sxy

Allen isn't really the scariest little creature in nightmare school. In fact, he's kinda adorable. This isn't really a trait that goes well in his world, so Allen sets out on a journey to make himself terrifying by eating the heart of a ferocious creature in a distant forest. I'm not sure if the heart is imbued with magic that will make him terrifying, or it's just the fact that he ate a freakin' heart.

The thing that makes *Terra Noctis* (which translates roughly from Latin to 'land of the night') really stand out is its graphics. They're simply superb, with a beautiful, hand-drawn feel, smooth animation and great use of parallax backgrounds. The score is suitably nightmarish-meets-cute and combined, the two add an atmosphere that makes this game really memorable.

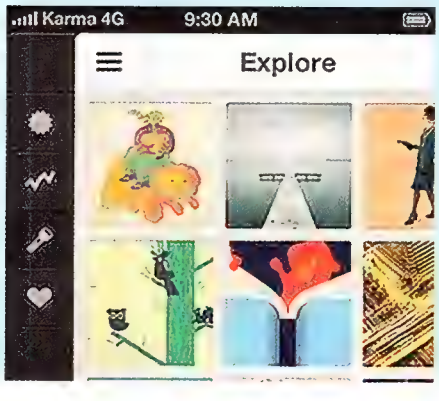
There are 30 levels to complete with features like shooting, power-ups and puzzles being introduced as you progress. Within each level, you can collect letters (S C A R E), blue fairies, red fairies and coins. Temporary power-ups are available by cashing in your blue fairies and you unlock the subsequent worlds by cashing in the blue fairies, and bonus levels from the coins.

It's a beautiful game with enjoyable (if not flawless) gameplay and at 99c, it's a less terrifying prospect than Allen would have liked.

Kuvva

$1.99 | Present Plus BV | tinyurl.com/akjw7vm

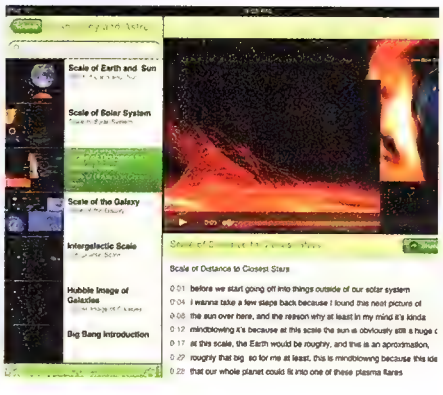
The wallpaper on your iOS device is a simple element that you can change to make the device just a little more 'you'. Finding the special wallpaper that successfully projects your core interests, while still looking attractive, can often be a difficult task. Kuvva brings together a list of attractive wallpapers, including a curated 'Featured Artists' section. If you start a Kuvva account, you can save favourites and access them from the Mac app (if you have one of those) and go for the whole 'matching' thing.



Khan Academy

Free | Khan Academy | tinyurl.com/b53su3t

Access any of the 3,200 educational videos made by the not-for-profit Khan Academy. With topics including maths, history, health, finance, science, astronomy, economics, cosmology, art history, economics, computer science and more, there's something to sate almost anyone's curiosity. All the videos have subtitles, which is handy for revision. If you have an account, you can bookmark your progress through the lectures, gain credit and earn achievements. You can even download the videos for later offline viewing.


Scale of Earth and Sun
Scale of Solar System
Scale of the Galaxy
Intergalactic Scale
Hubble Image of Galaxies
Big Bang Introduction
Scale of Distance to Closest Stars

Beat Sneak Bandit

$2.99 | Simogo | tinyurl.com/bf2ztld

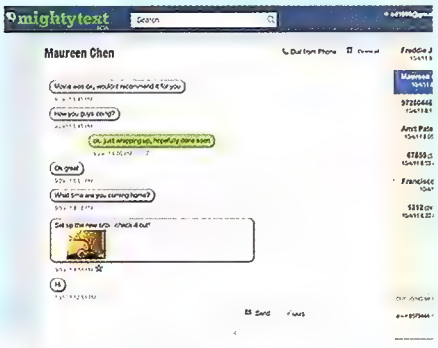
Stealth platformer meets rhythm game in this attractive, creative, '50s-inspired beauty. You can only move your character on the beats of the music, and you do so by tapping in time. It's more than just keeping a rhythm, however, as most of the challenge is actually in finding a safe route through the level. As a beat game, it's important that the music is listenable and we're in luck, as its old-meets-new soundtrack perfectly complements the overall retro vibe of the game.

Google Play | ANDROID

MightyText

Free | MightyText | tinyurl.com/6w5sx56

MightyText provides you with a web interface for sending and receiving SMS and MMS from your phone. It also comes with a Chrome/FireFox plug-in that provides pop-up alerts for both incoming SMSs and phone calls, even when you don't have the web page open. I find this handy for those times I'm listening to music on headphones and can't hear my phone ring. The more obvious utility, though, is the ability to use a real keyboard when responding to text messages. There's no excuse for poor grammar now.



Zooper Widget Pro

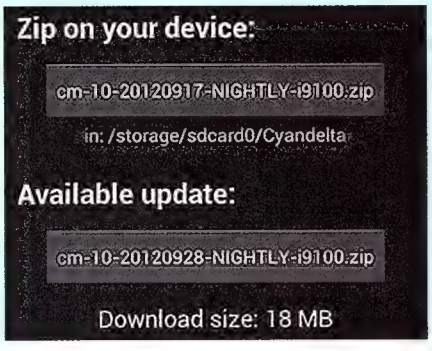
Pro: $1.99 (ad-supported available) | Zooper Inc | tinyurl.com/agcau4r

Minimalistic text has long been my favourite of the text-based clock widgets, but Zooper is a newer contender that offers a simpler setup, attractive templates, just as much customisability and adds in overlapping text. You can display the time and date for any or multiple time zones, battery level, calendar events, current weather and forecasts, sunrise/sunset, system info and more. You have full control of the layout – including text direction, position, colour, font, shapes, and more – and pro users can save templates for use again later.

CyanDelta Updater

Free | Mattia Baldani | tinyurl.com/99cgcl6

CyanogenMod is the most popular Android ROM out there and ROM addicts all over the world eagerly await the latest nightlies, so they know they're running the very latest in development builds. Even if you don't update daily, redownloading a whole ROM just for a few published changes is wasteful, especially when done over 3G. So, use CyanDelta Updater to only download the changed files and then have them integrated into your update.ZIP before re-flashing. This can reduce your download from around 200MB to around 18MB (YMMV).



Rayman Jungle Run

Rayman's first foray onto the smartphone is a shining success.

$3.36 | Ubisoft Entertainment | tinyurl.com/clmxtqn

Rayman Jungle Run brings our favourite limbless protagonist to Android (and iOS) in the form we best love him for: the 2D platformer.

Given their uncomplicated nature, platformers are perfectly suited for mobile devices, so they've become both insanely popular and abundant. A character tie-in therefore isn't enough to stand out in this crowded room. Thankfully, *Jungle Run* offers more than just this.

To simplify the transition to touchscreen, the game adopts a one-button control scheme, with a touch activating a stage-relevant action. There are 40 levels in total, with 10 each belonging to one of four stages/actions: jump, fly, wall run and punch.

As the title of the game implies, you're perpetually running (through a jungle, no less), with the goal of the game to collect all 100 'lums' (glowing bugs) in each level. Rewards are based on the number that you collect and are divided into the common three-tiered system, with a perfect score receiving a tooth. Collect enough teeth to fill the Grim Reaper's gaping maw and it'll unlock an extra difficult bonus level. This gives the game great replay value, mixed with just the right amount of frustration, as some levels will require millisecond accuracy.

Windows Store | WIN PHONE 8

Gerbil Physics

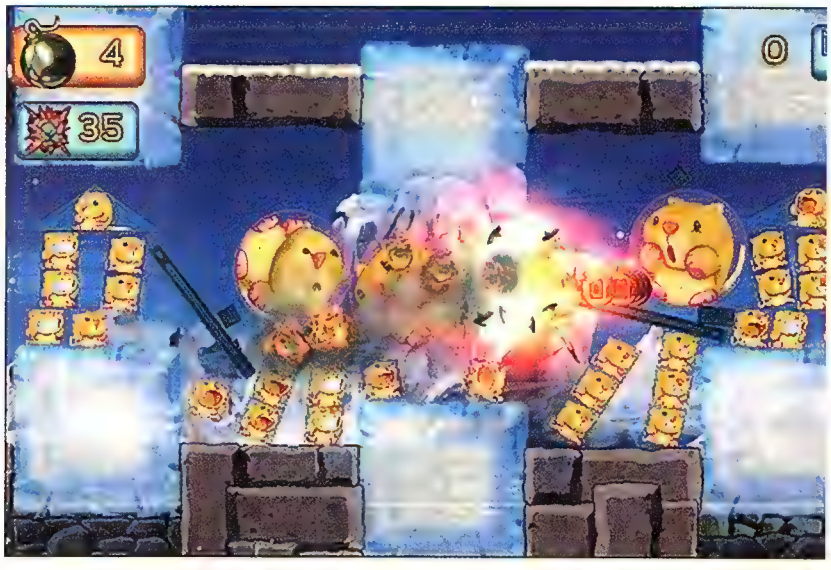
These gerbils aren't so much angry, as cute.

$3.49 | Microsoft Studios | tinyurl.com/aexw975

Gerbil Physics is a very cute physics puzzler. You place any of three types of explosives around the level to blow up structures, with the goal to get all the gerbils to fall below the yellow line. The gerbils are impervious to the explosions and instead of making shrieking sounds of terror as they burn up, they make cute little squeals as they go flying.

The bombs can be placed anywhere and you can have as many onscreen as you want. This allows you to set chain reactions and also (on those levels with moving objects) has you tapping the screen like a woodpecker. The more frugal you are with your munitions, the more points you earn on the level.

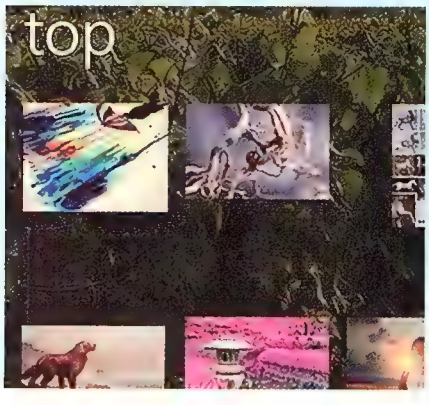
The cute graphics and sounds set this game apart from the many physics-based puzzlers available on mobile devices, and the lengthy gameplay (84 levels in total) combined with achievements, will be sure to give you hours of entertainment.



Tola

Free | Cloetn | tinyurl.com/bczt9bj

deviantART is a great way for an artist to host a portfolio, but, equally, it's great for those inept lovers of art, to view some amazing pieces. Tola allows you to browse deviantART by category, top-viewed images and three dozen or so 'Daily Deviation' images. The lists of images show thumbnails, which link to slightly larger images suitable for onscreen viewing. If you dig an image, you can view it on the deviantART site, or save it to your phone.



Potion Lore

$3.49 | Hexfire Software | tinyurl.com/bjrcucu

Potion Lore is a logic-based, avoid-the-guards-style puzzler, not too different to what we've seen before. The object is to make your way along the path to the exit avoiding enemies (and throwing potions at them), flicking the appropriate switches and fighting the occasional boss. The boss fights are a nice addition to the standard puzzle feel of the game and provide you with some relatively intense gaming action. With over 50 levels, you'll get hours of play from this little puzzler.

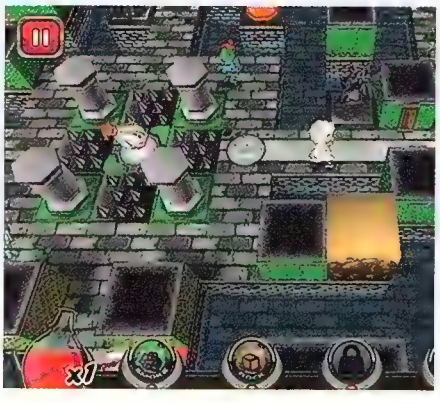
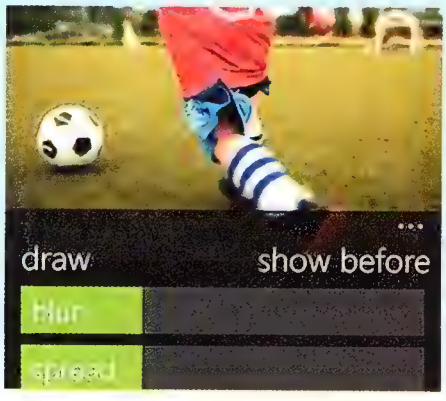


Photo Shader

$0.99 | Ryken Apps | tinyurl.com/b67t9lq

Photo Shader is a photo editing app, complete with crop and rotate, colour balance, brightness and contrast, saturation, exposure, tone, gloom, blur, distort, a bunch of retro/readymade filters, an undo history and more – 39 in total, actually. What's really cool about it is that you can draw the effects onto the image, allowing you to selectively and creatively add effects to parts of your image. There's even a Live Tile that can optionally show a collage of recent images, or just the most recent.

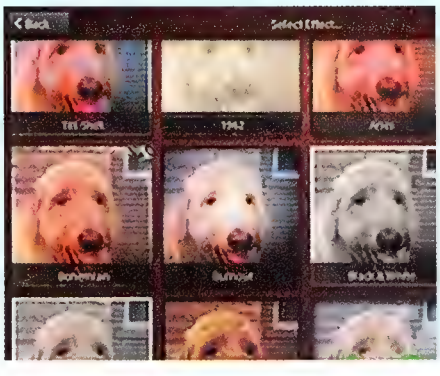


App World | BLACKBERRY

InstaPhoto

US$2.99 | Smarter Apps | tinyurl.com/bg8a8qu

InstaPhoto comes with 25 effects, including tilt-shift, borders, colour effects, textures and decorative frames. Selecting the perfect effect is made simpler by the selector showing previews on the image that you wish to apply it to, rather than just a generic one like many other apps. Images are stored in a separate folder to your camera images and are shown on startup. Optionally, you can enter your Twitter details and have the photos from your tweets appear there.



A Day in Life – Journal

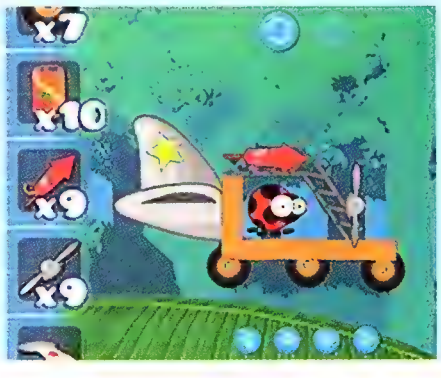
US$1.99 | XLabz Technologies Pty Ltd | XLabz Technologies Pty Ltd

I really enjoy keeping journals. It's a great way to reflect upon your activities, help commit them to memory and also save them for posterity. But with a plethora of digital media available to enhance your entries, paper journals no longer cut it. Posts can be tagged by location and include the current weather. You can also view entries in four different views: a visual timeline, photos, calendar or just your favourite entries.

FlyCraft

US$1.99 | Charilaos Kalogirou | tinyurl.com/b2l8d9d

You know those flying man challenges, where you have to build a flying machine and then run off the end of a pier to see how far you can fly? I've never wanted to compete in one of those because building a contraption in real life is just too much effort for me. Now, with the FlyCraft app, you can build whatever machine you wish, propel it down a ramp and watch with glee as Herbie the Ladybug does his best to end up in a tiny wheelchair.



Viira – Get Things Done On The Go

A serious GTD-focused task manager.

US$29.99 | Karta Mobile Inc. | tinyurl.com/am7xxlh

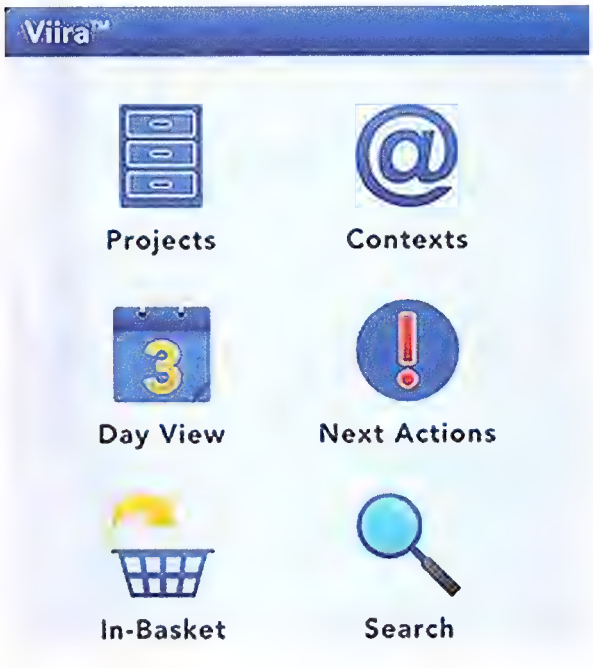
Getting Things Done (GTD) is held to be the king of task management methodologies, and having an app that's not only designed to work hand in hand with its concepts, but is also heavily integrated with the tool at the heart of many people's work lives (I'm talking about your BlackBerry) is a boon.

You can use Viira to organise the tasks, emails, appointments and SMSs on your BlackBerry by project, context (that is, location) and time. Better yet, you can tag tasks with multiple contexts; for instance, 'Buy a fake beard' can be tagged under both 'Errands' and 'City'.

Tasks in Viira sync with BlackBerry Tasks (so you can sync them to the cloud with a third-party app) and Calendar (so you can view them alongside your daily appointments). Any phone numbers, email addresses and URLs stored in the tasks are clickable, making them easy to dial, email or visit.

Tasks can also be linked to contacts, making it a cinch to call, message or email the person that the task concerns.

At around $30, it's on the expensive side for app purchases, but it's so well integrated, and can potentially make such a difference to your work day, that it's probably a sound investment. Thankfully, though, it's not a gamble, as there's a free trial version available so you can give it a whirl before forking out any cash. apc



THINGS THAT GO BOINC

Building a computer that offers good performance for the University of California's BOINC grid computing projects? Darren Yates takes on an unusual challenge.

This month's build request came from Murray Pearce, who had an unusual requirement: build a system that offers high data/transaction throughput for the BOINC project at the University of California. If you don't know about BOINC, take a look at **boinc.berkeley.org**. It allows research organisations and universities (as well as individuals and companies) to use your spare CPU (or GPU) speed to process data for a range of projects, mostly in environmental studies and biology.

Murray already has three decent systems based on Intel's Core i7-920, Core i5-2500K and Core i7-3930K processors, and GeForce GTX 465, 560 Ti and 660 GPUs, respectively, all working on BOINC. All run Windows 7 64-bit with Service Pack 1 and boot up off 320GB audiovisual-grade hard drives with 'minimal' overclocking.

He's after a couple of system builds that will work well with BOINC with the following limitations:

- Money is an issue
- Only use one GPU
- Use the most cost-effective GPU available
- Use the most cost-effective CPU available
- Total power consumption must be less than 400W

THE OPTIONS: CURRENT SYSTEMS

I think Murray's Core i7-920 system with its LGA1366 socket should be left alone – some retailers want $1,000 for the next step up Core i7-940 chip, so unless Murray is prepared to rip the board out and start fresh, I'd leave it alone. I think most people would love to have a Core i7-3930K-based PC so I wouldn't bother touching that one either. His Core i5-2500K is worth a look though, running ASUS's P8P67 board. While he could upgrade this LGA1155 box with a Core i5-3570K CPU, the Core i5-2500K is a stellar overclocker, easily able to notch up 4GHz-plus. If the temptation already is to upgrade, I'd be cranking up the clock rate first just to see what extra performance I could get for free before I spent any money.

THE OPTIONS: OTHER IDEAS

If you're building a new system with BOINC high on the agenda, you'd first look at the projects you wanted the systems to participate in. Some BOINC projects have preferences for different hardware, based on their own in-house requirements. While there are dozens of projects, BOINC-recommended ones and their platform requirements can be found at **boinc.berkeley.edu/projects.php**.

First thing you'll notice there is that while the majority obviously support Windows, many support Linux, a smaller number support GPU computing and there are a couple that even run on ARM-based Android devices. I'll immediately put a plug in here for $50 mini PCs being ideal for this task – there's even an Android BOINC client called NativeBOINC, which you can download from **nativeboinc.org**. But since it was only released in March 2012, there are just seven projects that support ARM so far: only three make the BOINC 'known' list and only one of those is a university project (MilkyWay@Home). Still, give it time.

In the meantime, if your favoured project supports GPU computing and runs on Linux, that's the ideal since you can either save money by not buying Windows or you can put the cash towards a better graphics card. To see which projects support GPU grid computing, head to **boinc.berkeley.edu/wiki/GPU_computing**.

THE BUILDS

Murray has set a stiff challenge, given the application and the required limitations. He didn't give monetary amounts to work with, so we've gone for three different builds priced at around $600, $900 and $1,200, respectively.

PROCESSOR

Some will disagree passionately that we've not included overclockable Intel chips, but there's some method in our apparent madness. First, Murray wasn't interested in overclocking; second, money is a concern so keeping a lid on costs is important; and third, with only 400W to play with, overclocking won't help keep a lid on power requirements.

MOTHERBOARD

My view on motherboards is not to overspend, particularly if the budget is tight – the performance differences here are minimal at best, so we've gone for a basic AMD 780G board for the AMD system, a Z77 board for the Core i7, an H77 for the Core i5 and nothing over $100. B75 chipset boards will save you more but only come with one SATA 6Gbps port – if you're doing nothing but BOINC, it'd be enough.

ASK US!

Looking to make your perfect PC, but not sure what parts to buy? Every month, our PC expert Darren Yates solves a readers' PC building quandary. Email us at contact@apctest.com for your chance to get building!

RAM

Since BOINC is about number-crunching, RAM speed makes a difference, even more so than the amount. To keep costs down for the AMD entry-level system, we've gone for 4GB of DDR3-1600, which is as fast as this board will take anyway. DDR3-2133 RAM is cost-effective enough for 8GB in the Core i7 box and 8GB of 1,600MHz RAM will do the Core i5.

GPU

As we said before, the GPU you choose depends on the projects you want to support. If they don't support GPU processing, stick with the CPU's integrated GPU and plough the cash back into a faster CPU. Nvidia's GeForce GTX 660 OC edition should have no trouble conjuring up decent CUDA horsepower. And trying to keep a lid on the cost, we've gone for AMD's Radeon HD 7770 for the budget build. If you're prepared to spend more, you can easily grab a faster card; however, it probably won't be cost-effective and we'll have trouble keeping under 400W of juice.

STORAGE

BOINC installs executables onto your system to process project data, so fast storage is a must. It doesn't use much storage so the choice here depends on what else you'll use the system for. With 128GB SSD prices now down to around $100, we're even giving the budget build a SanDisk Extreme to play with, along with a 1TB Seagate 7,200rpm hard drive for more general storage. We've gone for a 256GB OCZ Vertex 4 SSD and 2TB Seagate 7,200rpm hard drive for the Core i7 box, which should really help this one scream along. The Core i5 box gets the 128GB and 1TB equivalents of those drives, again keeping a lid on costs.

OPERATING SYSTEM

Remember that with many BOINC projects supporting Linux, you may not need to use Windows if BOINC is your major reason for building. Some projects like SETI@Home only work with Windows and if you want a more general-use system build, the 64-bit version of Windows 7 Home Premium SP1 would be our choice. The faster boot times of Windows 8 may be worth considering, but for all-round value, we'd stick with Windows 7 Home Premium.

HORSES FOR COURSES

We've definitely hedged our bets with these builds and edged a little more towards general use than exclusive BOINC processing. If BOINC is all you want to do, rip out the hard drives and just run the BOINC client and operating system right off the SSDs, since you won't need storage for anything else. The cash saved can go towards a faster CPU, GPU or RAM.

You can see that trying to keep a build to a budget is about sorting out where to best spend your dollars, so for single-application builds like this, you need to understand how your app works and what it needs most to perform at its best. For BOINC, it's processing more than storage. For other apps, it might be storage more than a GPU. Whatever it is, knowing your app needs will always point you in the right direction. BOINC

BOINC-READY DESKTOP PCs: THE OPTIONS

	BUILD #1	Cost ($)	BUILD #2	Cost ($)	BUILD #3	Cost ($)
CPU	3.1GHz AMD FX-8120	$170	Intel Core i5-3570	$209	Intel Core i7-3770	$299
Motherboard	Gigabyte GA-78LMT-USB3	$79	Gigabyte GA-H77M-D3H	$89	Gigabyte GA-Z77MX-D3H	$100
RAM	4GB DDR3-1600	$21	8GB DDR3-1600	$45	8GB DDR3-2133	$65
Graphics card	Sapphire Radeon HD 7770 1GB	$129	Gigabyte GeForce GTX 660 OC 2GB	$249	Gigabyte GeForce GTX 660 OC 2GB	$249
SSD	128GB Sandisk Extreme SSD	$100	128GB OCZ Vertex 4	$117	256GB OCZ Vertex 4	$240
Hard drive	1TB Seagate ST1000DM003 SATA 6Gbps	$77	1TB Seagate ST1000DM003 SATA 6Gbps	$77	2TB Seagate ST2000DM001 SATA 6Gbps	$100
Case	Generic 500W case	$50	Generic 500W case	$50	Generic 500W case	$50
Operating system	Ubuntu 12.10 Linux	$0	Windows 7 Home Premium SP1 (64-bit)	$95	Windows 7 Home Premium SP1 (64-bit)	$95
	TOTAL COST	**$626**	**TOTAL COST**	**$931**	**TOTAL COST**	**$1,198**

NETWORKING

THE EXPERT'S GUIDE TO WINDOWS NETWORKING

Delve into the nuts and bolts of networked sharing with Neil Mohr.

Networking has become one of the most essential elements of computing. Forget processors. Forget graphics cards. Forget memory. If you can't get networked at home and onto the internet, we're pretty sure we know what your reaction is going to be. While you can live without 3D graphics and even the cutting-edge multicore processor, try living without your home network for half an hour and you'll run screaming into the night with the wail of "Wikipediaaaaaa" trailing after you.

We know you can string together your own home network. A wired network is sheer block-building child's play. A wireless network isn't much more strenuous, largely thanks to WPS reducing the complicated bit to little more than a button press or two. Or if you're like us, you might memorise your WPA key, being able to think for ourselves and all.

We're actually here to delve into the murky world of Windows networking and file sharing. We're not talking the HomeGroup system here; Microsoft has done a decent job of making that easy enough to use. We're going to delve into the Windows NT networking system that underpins this and indeed all of Windows file sharing. That's the key here – not only does it arm you with the knowledge to twiddle with network shares on Windows 7, but without too many complications, everything from Windows NT, XP Server right through to Vista and Windows 8.

It's a reassuringly complex system; however, once you understand the basic elements of it, it's easy to deploy with total control, allowing you to decide who, how and exactly what is shared and accessible over your network. Let's not forget the ability to limit, monitor and revoke access, too. Like we said, HomeGroup is fine if you're seeking the basic control. For complete control, you want to unleash the full Windows network file sharing.

So why should you care to learn the hard way when Microsoft goes to all that time and trouble to provide an easy route? Frankly, because it offers far more flexibility for a little more investment of your time. Besides, once you've nailed the more complex systems, they work with and are the HomeGroup system anyway. So you can pick and choose depending on how tiered you want to make your file sharing access.

The truth is that the networking which exists inside all of Microsoft's current products is the same underlying system that was built into Windows NT back in 1993. As you should know, Windows NT became the core of Windows 2000 aka NT 5 and then Windows XP as NT 5.1. The whole Windows range was effectively merged with Windows Vista as NT 6 and onwards. Technically, Windows 8, RT and Server 2012 will all be based on Windows NT 6.2.

This underlying architecture for Windows NT has remained the same then, with security handled through the Security Reference Monitor system, using Access Control Lists and unique Security Identifiers (SIDs) to orchestrate this symphony.

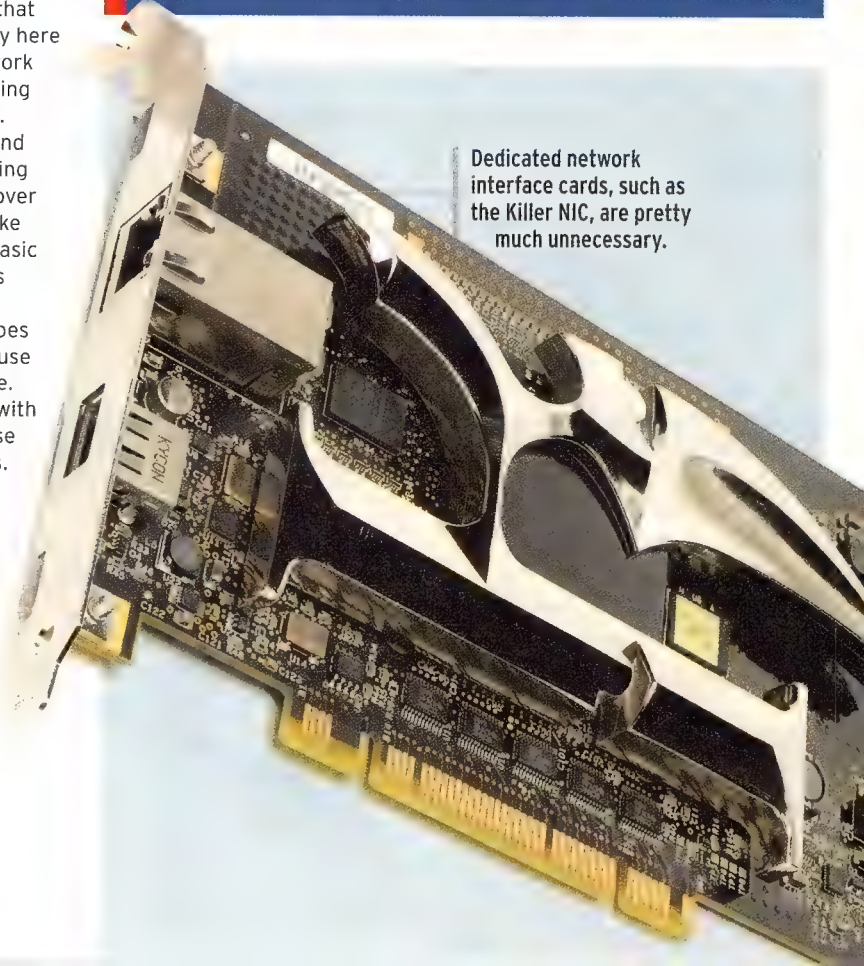
JARGON EXPLAINED

NetBIOS (Network Basic Input/Output System). An old network protocol that provides PC communications. It still exists and runs over the Transmission Control Protocol (TCP).

DLNA (Digital Living Network Alliance). A network standard that enables different devices to share digital content between one another. It's a bit rubbish.

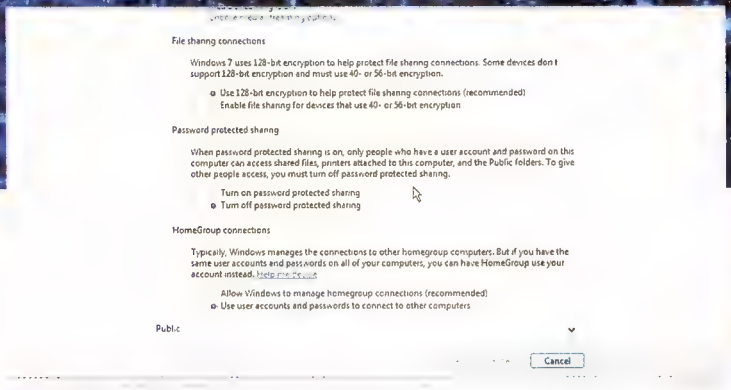
Windows NT (Windows New Technology). The name for the original from-the-ground-up rewrite of Windows. At the time, it was groundbreaking OS technology.

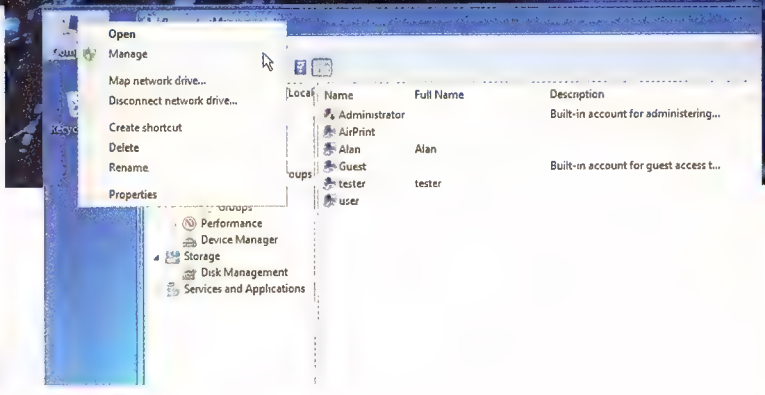
NAS (Network-Attached Storage). This refers to a storage device that's network and TCP aware, and able to share its storage over a network using standard protocols, such as FTP and Samba.



Dedicated network interface cards, such as the Killer NIC, are pretty much unnecessary.

WE'RE THE MANAGEMENT


File sharing connections
Windows 7 uses 128-bit encryption to help protect file sharing connections. Some devices don't support 128-bit encryption and must use 40- or 56-bit encryption.
Use 128-bit encryption to help protect file sharing connections (recommended)
Enable file sharing for devices that use 40- or 56-bit encryption
Password protected sharing
When password protected sharing is on, only people who have a user account and password on this computer can access shared files, printers attached to this computer, and the Public folders. To give other people access, you must turn off password protected sharing.
Turn on password protected sharing
Turn off password protected sharing
HomeGroup connections
Typically, Windows manages the connections to other homegroup computers. But if you have the same user accounts and passwords on all of your computers, you can have HomeGroup use your account instead.
Allow Windows to manage homegroup connections (recommended)
Use user accounts and passwords to connect to other computers
Public
Cancel

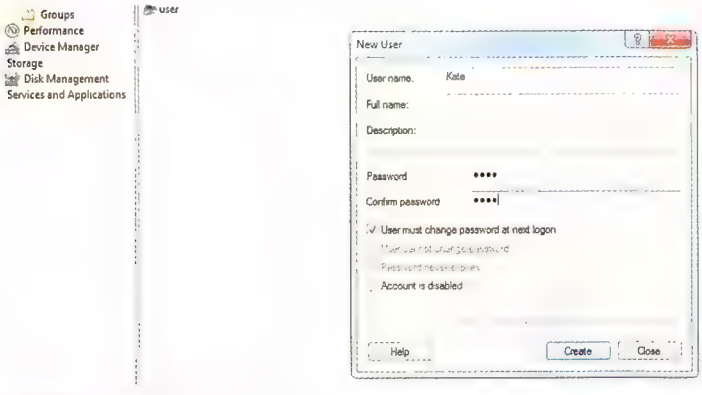


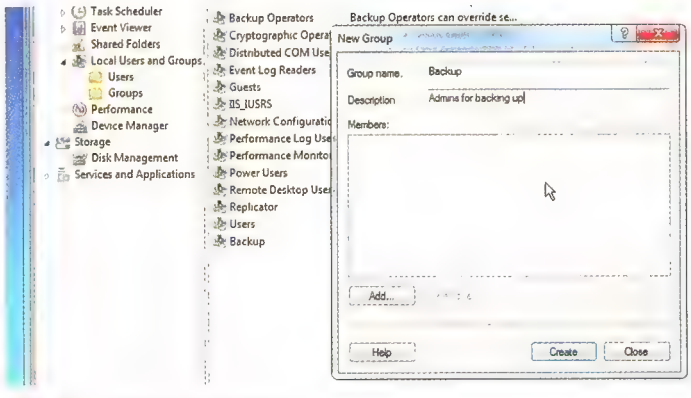
01 ADVANCED SETTINGS

Right-click the 'Notification Network' icon, select 'Open Network > Sharing Center'. Click the 'Change advanced sharing settings'. The quick list is: 'Discovery' on, 'Sharing' on and 'Public' off; select 'Media' and '128-bit encryption'; and finally 'Passwords' off and select 'Use user accounts'.

02 THE CONSOLE

We'll use the Computer Management Console a lot. Right-click the 'Start' menu's 'Computer' entry and select 'Manage'. Open the 'Local Users and Groups' section and select 'Users'. We'll be taking a look at 'Groups', as well as the 'Shared Folders' section.



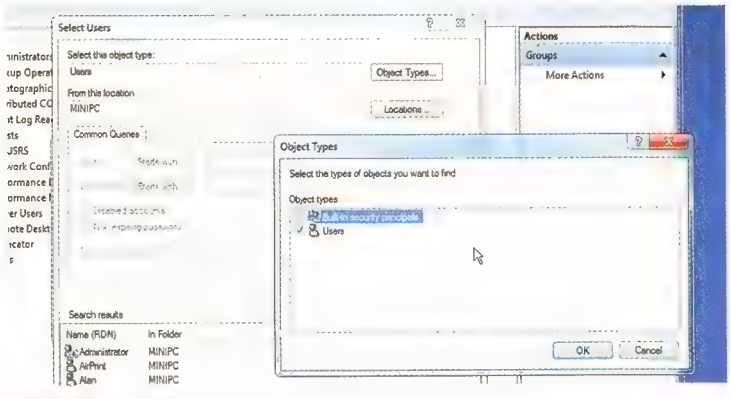


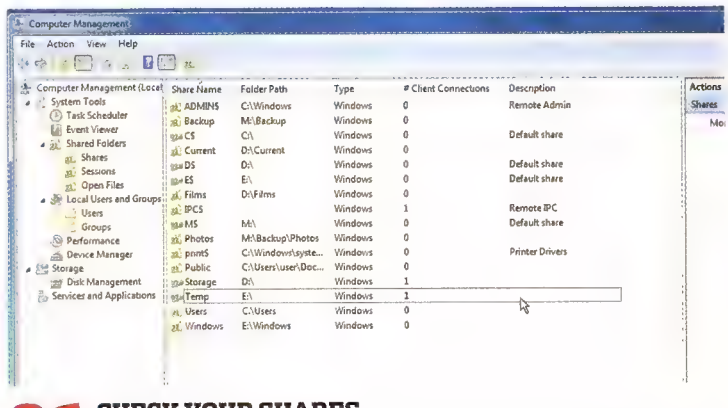
03 ADDING A USER

Creating a new user account is straightforward. Right-click a blank area of the main 'Users' display and select 'New User'. The username needs to match the account name of the remote PC. You can give it a friendly name and the all-important password.

04 CREATE A GROUP

You can apply access by the same groups of users by creating groups and adding the users you want to this. Select 'Groups' and then right-click and select 'New group'. Choose a name and click the 'Add' button to begin adding the users you want to the new group.





05 ADDING USERS

We'll see this stupid dialogue again. Click 'Advanced > Find Now'. This actually displays the list of users you can add. If you like, select 'Object Types' and deselect 'Built-in security principles' to simplify the list. Select as many as are relevant and click 'OK'.

06 CHECK YOUR SHARES

Finally, take a look at the 'Shared Folders' group. It's worth clicking the 'Shares' entry, as this lists all the folders and drives that are set as being shared on the system. By default, a number exists already and these are system shares for the default user only.

HOME NUISANCE

Over the years Microsoft has attempted to simplify the job of managing networked file shares, which only helped to confuse the situation. We'll take advantage of some of these interface changes since they offer shortcuts to sharing folders, but we're going to avoid HomeGroup.

HomeGroup is a streamlined way of getting file sharing to work over a home network. Similar to wireless networking WPS, it uses a PIN to prove valid authentication between systems. This is great if you can be bothered with difficult-to-remember 10-digit PINs and having to change all those default folders, so you don't share them with every Tom, Dick and Harriet each time you initiate it.

It's not a bad system, but it's still riding on the coattails of something that's more flexible. We also worry that it hands access to remote systems without any additional credential checking, which is to say once a PC is given access, it always has access no matter who's using it. So if PC A used by Bob is given access to PC B, when little Timmy gets on PC A, Timmy's going to be able to access everything on PC B. It also doesn't help that networking issues are painful to diagnose, while the easy-to-use interface elements plug into the traditional networking anyway.

Part of this new system is the somewhat pointless 'Set Network Location' selection. Get to it by selecting 'Start > Control Panel > Network and Internet > Network and sharing' and under 'View your active networks', select the current 'Home/Work/Public network' link. The only reason to select 'Home network' is that it enables HomeGroup, while 'Work network' disables HomeGroup.

The 'Public network' option is handy as it locks down network access to the system when on an untrusted network. Despite its semi-hidden nature, this presents a useful way of turning off the HomeGroup, though the additional HomeGroup home will stay visible in the 'Navigation' pane until the sun engulfs the Earth in its fiery embrace. Thanks Microsoft.

GROUP HUG

With that unpleasantness done away with, we can focus our attention on how the core Windows networked file sharing works. We're not starting at the beginning, as you were expecting. Instead, we're going to look at Windows User Accounts. What on Earth has that got to do with networking? Well, Groups, Users and Login sessions are core to the Windows security system. You're going to be able to enable remote access to systems on three levels.

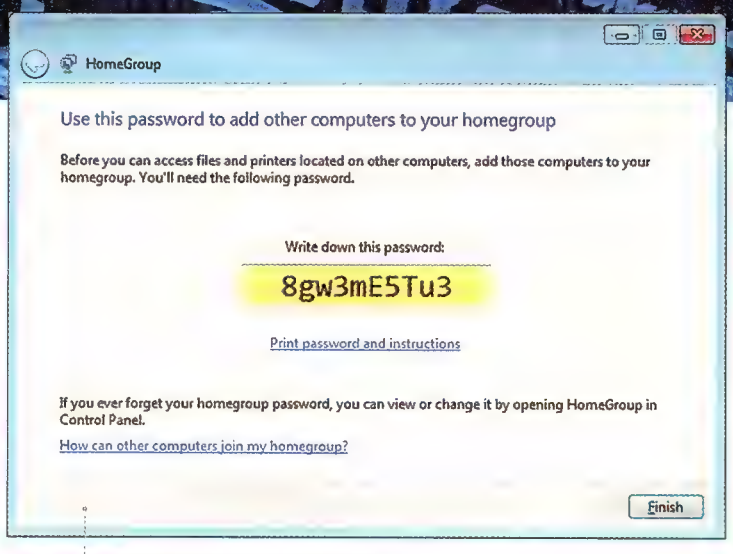
The first is the Public shared folders that anyone can access. The next is Guest group access. This is for anyone who doesn't have a user account. Finally, there's User Account access, which requires that you enter credentials to access shared folders from a remote system.

This complex arrangement ultimately results in a highly flexible one, with the small amount of initial user and group setup easy enough to manage. It enables you to create groups that all have the same access privileges or provide personalised access to files and folders on an individual user basis. This also goes hand in hand with password protection and policy control over the password usage.

On a basic level, users can be created and managed via the standard 'User Accounts' applet in 'Control Panel' and if you want it, it's easy to enable the 'Guest Account' access level here, too. However, we find the best method is to do this via the Computer Management Console. Access this by either typing **compmgmt.msc** into the 'Run' dialogue, or right-clicking 'Computer' (the desktop icon or 'Start' menu entry) and select 'Manage > Local Users and Groups'.

It's also worth mentioning at this point the 'Shared Folders' section that handily lives just above 'Local Users and Groups'. As you create file and folder shares these will become listed under the 'Shares' section. This makes the Computer Management Console a good way to manage most aspects of networked file sharing from one place. Over time, if you're sharing a good number of folders, it can become confusing as to exactly what you've shared and with who. The 'Shares' section offers a list of everything shared in one place and with all the controls you need. Right-click the share you're interested in and you can immediately stop sharing or choose 'Properties' to adjust the sharing options.

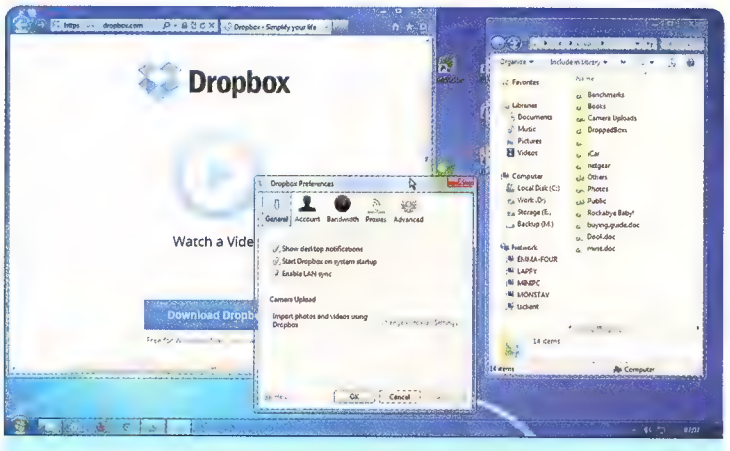
This 'Users Properties' dialogue enables you to limit the number of users that can have active sessions. For the most part, this won't be of use for home users, but there are times when this could be helpful, if


HomeGroup
Use this password to add other computers to your homegroup
Before you can access files and printers located on other computers, add those computers to your homegroup. You'll need the following password.
Write down this password:
8gw3mE5Tu3
Print password and instructions
If you ever forget your homegroup password, you can view or change it by opening HomeGroup in Control Panel.
How can other computers join my homegroup?
Finish

HomeGroup requires a 10-digit PIN every time it's initiated for file sharing.

NETWORK ICON

Add the Network shortcut to your desktop by right-clicking a blank area, selecting 'Personalize > Change desktop icons > Network'. Do the same for the 'Start' menu via the 'Properties' section.



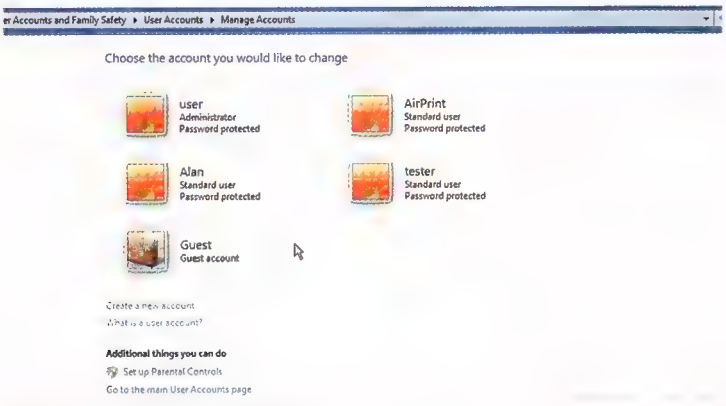
Cloud storage services such as Dropbox offer another folder sharing option for a home network and across devices.

TO THE CLOUD

An interesting possibility with shared folders is to combine them with Dropbox, Box or a similar internet storage service. Ideally run with a home server, this provides a universal cloud system with files available to everyone at home, but also synchronised to any other devices that are running the storage service. Of course, this will be limited by the capacity of the service. Dropbox offers between 2GB and 18GB for free, Box offers 5GB and Microsoft SkyDrive gives you 7GB. All of these can be expanded if you pay a monthly fee and it provides an interesting, easy and secure way to keep files available to everyone, everywhere.

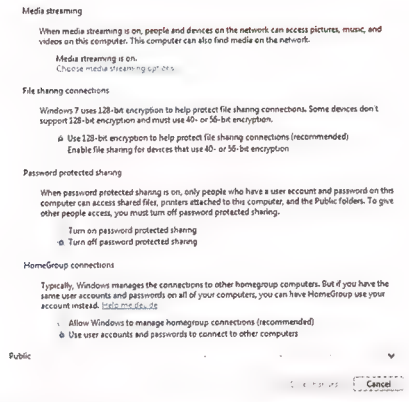
Along a similar line is using a shared folder for backup and synchronising. We recommend a cool program called SyncBack from **2brightsparks.com**. Fully functioning free and paid versions are available and it works in multiple ways. The first is a straight backup regime to copy modified files to a remote shared folder. The other is synchronise mode, where it will keep the files on your system and a remote folder in sync. This enables you to work locally on documents and have them automatically updated on a remote folder so others can access them as well.

CREATE GUEST SHARE ACCESS



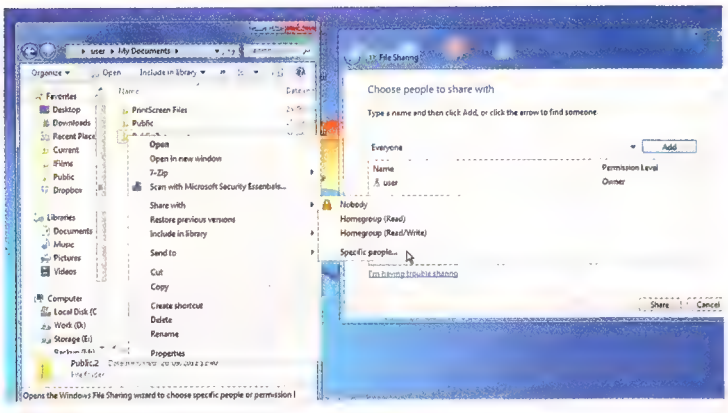
01 GUEST ACCOUNTS

First, make sure your shared system has a Guest account created and active. Select 'Control Panel > User accounts > Add or remove user accounts'. The Guest account is shown here and it'll be active or off. You'll need to activate this before going any further.


Media streaming
When media streaming is on, people and devices on the network can access pictures, music, and videos on this computer. This computer can also find media on the network.
Media streaming is on.
Choose media streaming options
File sharing connections
Windows 7 uses 128-bit encryption to help protect file sharing connections. Some devices don't support 128-bit encryption and must use 40- or 56-bit encryption.
Use 128-bit encryption to help protect file sharing connections (recommended)
Enable file sharing for devices that use 40- or 56-bit encryption
Password protected sharing
When password protected sharing is on, only people who have a user account and password on this computer can access shared files, printers attached to this computer, and the Public folders. To give other people access, you must turn off password protected sharing.
Turn on password protected sharing
Turn off password protected sharing
HomeGroup connections
Typically, Windows manages the connections to other homegroup computers. But if you have the same user accounts and passwords on all of your computers, you can have HomeGroup use your account instead. Help me decide
Allow Windows to manage homegroup connections (recommended)
Use user accounts and passwords to connect to other computers
Public
Cancel

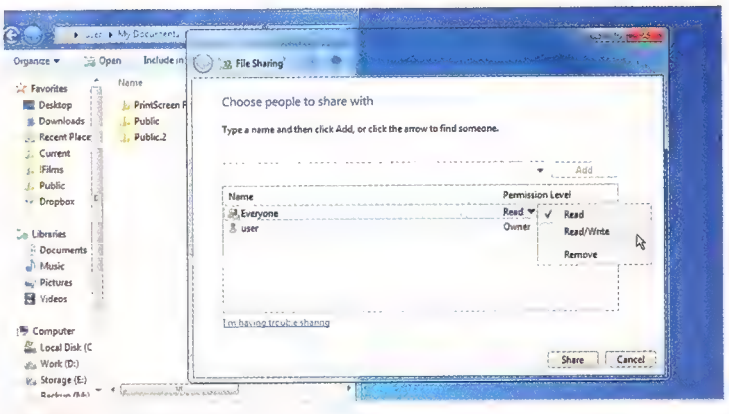
02 GUEST ACCESS

Right-click the 'Notification Network' icon to check the basic sharing settings, select 'Open Network and Sharing Center > Change advanced sharing settings'. 'Public sharing' can be left off, but make sure 'Turn off password protected sharing' is selected.



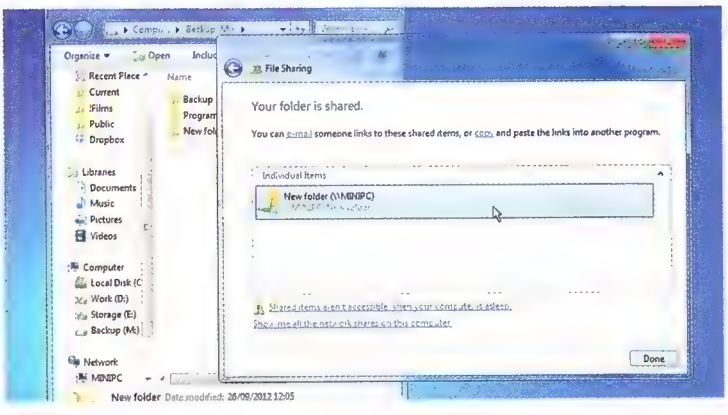
03 ADD GUESTS

Let's guest share a folder. For example, create a 'Public' folder by right-clicking this and selecting 'Share > Specific people'. This is the HomeGroup extended interface, so you can choose 'Everyone' and click 'Add'. The 'Guest' option would work just as well, too.



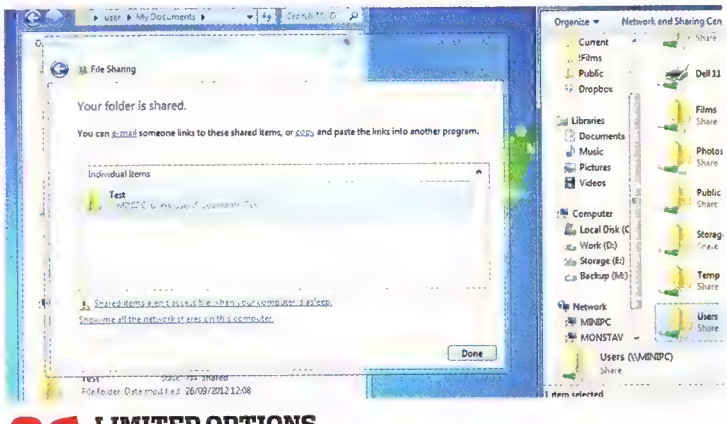
04 ADJUST READ/WRITE

When a user is added this way, you can adjust the level of access via the 'Permission Level' column. Click the arrow next to the 'Read' option and select 'Read/Write' to enable guest users to copy files into and out of the 'Public' folder.


File Sharing
Your folder is shared.
You can e-mail someone links to these shared items, or copy and paste the links into another program.
Individual Items
New folder (\\MINIPC)
Done
New folder Date modified: 26/09/2012 12:05

05 AND SHARE

With the 'Read-only' or 'Read/write' setting done, click 'Share' and the folder will be made available to everyone on the local network. The final window displays the network path to the folder and offers a couple of basic ways to send this to other people.


File Sharing
Your folder is shared.
You can e-mail someone links to these shared items, or copy and paste the links into another program.
Individual Items
Test
Done

06 LIMITED OPTIONS

Using the built-in HomeGroup controls does make sharing easier, although the flip side is that it offers less control over how the shared folder is created. So, if the folder already resides inside a share, it's not possible to create a separate listed shared folder this way.

bandwidth is an issue or you have a high number of users for some reason. The 'Share Permissions' tab is also useful for easily changing the access permissions for groups and users. It's unlikely you'll need to delve into the 'Security' tab, but this does offer more detailed control over what users can do within shares.

NETWORK NAMES

It's a minor point, but worth covering as it's certainly not obvious. When you're messing around with networking, the name of the PC you're working on, it's set via the 'Computer Properties'. Right-click either the desktop icon or 'Start' menu 'Computer' entry, select 'Properties' and under the 'Computer name' section, click the 'Change settings' link. Click the 'Change' button – why you can't just click this back in the 'Properties' is beyond us – and change the 'Computer name' to whatever you want to view within 'Network'.

You might also be wondering about the Workgroup name that can also be changed in here. Back in the day of Windows 3 and 95, this could be used to segregate PCs into groups, making it impossible for different Workgroups to share files or services. Today the Workgroup concept has been eliminated and it's effectively unused. It's all a bit of a blur now, but back in those days NetBIOS took the major lead in network file sharing, with the additional Microsoft SMB protocol on top of this. From Windows 2000 onwards, the Microsoft SMB protocol did away with NetBIOS and therefore the need for Workgroups.

Despite dumping NetBIOS to retain compatibility, the naming conventions for the computer and Workgroup remain. That's a case-free name, without any spaces, no longer than 15 characters long with restrictions on special characters, which is to say almost no punctuation apart from a dash.

NOT THAT ADVANCED

The most confusing aspect of Windows network file sharing is how to switch it to the correct mode, so that the PC is actually happy to accept password connections. This blazingly basic concept is buried in the 'Change advanced sharing settings' section found off the side panel of the 'Network and Sharing Center' in 'Control Panel'. The best way to access this is to right-click on the 'Notification Network' icon, select 'Open Network and Sharing Center > Change advanced sharing settings'. There's a list of very important options in here, many of which have to be set correctly for file sharing to work. Be aware these options are duplicated over two separate sections in here. One section covers the 'Home/Work Network Location' and the other below this covers operating in a Public Network Location mode. The first two options – 'Turn on network discovery' and 'Turn on file and printer sharing' – we hope are self-evident. Both need to be selected for this to work well.

The 'Public folder sharing' option is an interesting one. If you want a simple way to easily share files with everyone, this is a great option. The folder already exists within the <system drive>:\Users\Public\ folder. Be aware, this enables anyone connected to the same network as you to copy, move and delete any old files that they wish to within those public folders. This isn't the only way to provide simple password-free guest sharing, but it's a one-shot option you might be interested in.

The next two options we're going to skirt around. 'Media sharing' is something we've covered extensively in the past and media streaming is where you control the basic Windows Media Player and generic DLNA server features. The 'File sharing connections' option can be left at 128-bit encryption for better security. As far as we know this should function correctly with almost everything.

The 'Turn off password protected sharing' option is a prime one. If you're happy to have anyone access shared folders marked with guest access, then you can choose to turn this off. It's like public folder sharing, but across the board for any folders you mark for guest access. If you're happy to bare all to everyone on your home network, then this by far makes for the easiest file sharing method. You still retain complete control over who can delete files on your server or computer by adjusting controls accordingly, or limiting access completely by marking them only for registered users.

Finally, the 'HomeGroup connections' option needs to be turned off here so that we can control and create our own user permissions and

If you're sharing files from a server, powerline plugs are better than wireless.

NETWORK ARCHITECTURE

If you're sharing files from a server then it makes sense to keep connections to and from that as fast as possible. Try to connect via a Gigabit LAN cable for 1,000Mbps transfers rather than using a wireless connection.

Samba enables you to connect almost any device to a networked Windows system.

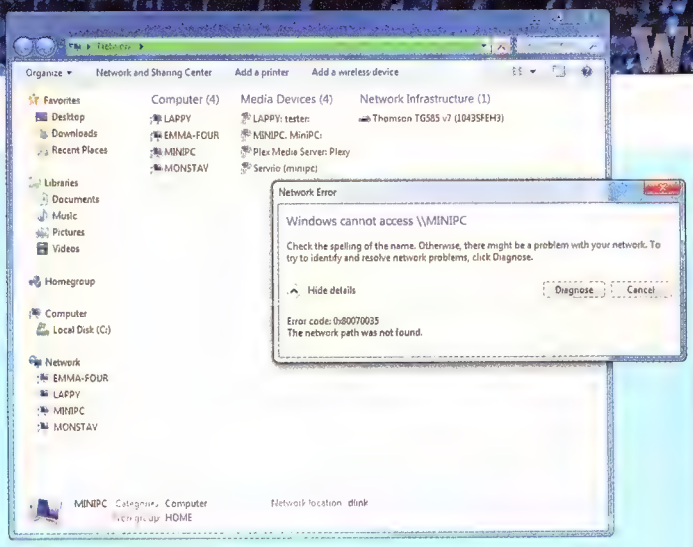
DEVICE SHARING

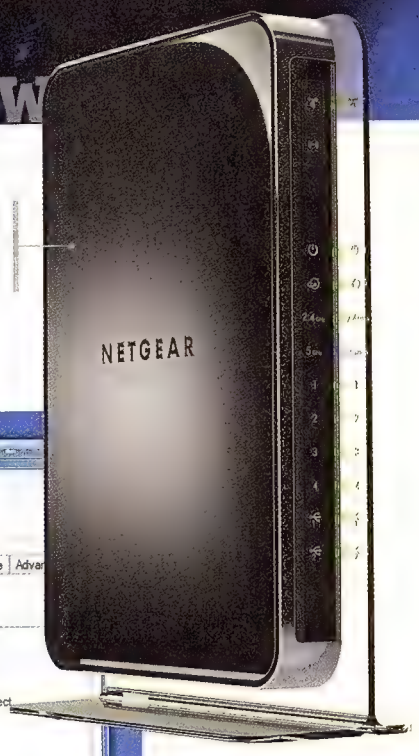
What we're playing with today extends beyond your standard Windows systems – good news, we think – to almost all other devices that can join a network. So if you have an Apple iPhone or iPad, an Android device and even Mac and Linux desktops, you're in luck, as they'll all play nicely together.

The reason these all work together like it's some sort of hippy commune goes back to the NetBIOS days and the need to connect DOS PCs to other devices over a network. To get everyone holding hands and singing songs, project Samba was created. If you recognise that name, it's because Samba exists today, all over the place, as it's an open-source system for networking.

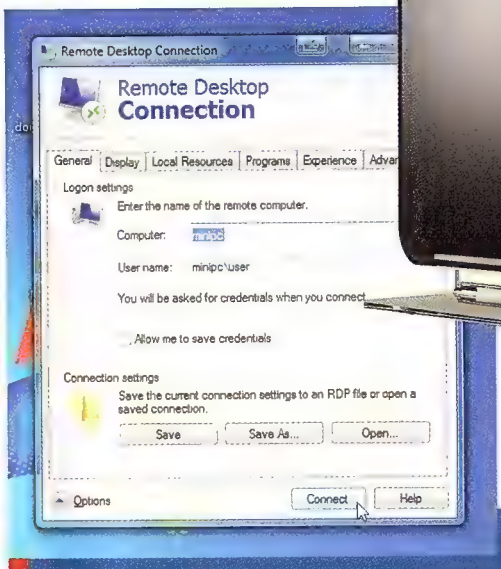
Samba enables you to connect almost any device to a networked Windows system, using either guest access or one of your predefined password-protected User accounts. Unfortunately, the Samba part of apps and the like can be implemented in many different ways. By that we mean in terrible ways. Usually the easiest way to connect is by using the Windows IP address of the PC. If you have a server, you might want to set it to a permanent IP address via your router's DHCP settings.

Well-designed apps will provide the NetBIOS name for the PC in a handy list of networked systems, but not always. This is also worth mentioning as many NAS devices also run an implementation of Samba (via their BSD-based OS) to enable them to connect over the Windows network, too. Hence they're also able to provide similar user/group structures and access restrictions.


Network and Sharing Center
Add a printer
Add a wireless device
Computer (4)
Media Devices (4)
Network Infrastructure (1)
Network Error
Windows cannot access \\MINIPC
Check the spelling of the name. Otherwise, there might be a problem with your network. To try to identify and resolve network problems, click Diagnose.
Hide details
Diagnose
Cancel
Error code: 0x80070035
The network path was not found.



Setting up a wireless network has become little more than a few button presses.



TROUBLESHOOTING? I'M THE FIRE STOPPER

Networking and problems seem to go hand in hand. If it's not an old router that needs resetting, then it's some crazy setting you've failed to tick that's blocking a port. A major issue with Windows file sharing is that so many of the options are spread over so many different dialogue boxes and different areas of Windows. If you find you're having issues connecting to a remote PC or getting access to a share, then let's go through the areas that can cause an issue.

It's always worth checking the physical aspects. During the time of writing, we couldn't access the server because it had powered down. Similarly check routers, connections and if you can, connect to the internet for general network function. Usually the PC's name should show up in the 'Network' folder almost instantly.

If the physical side is good, but the PC's name isn't showing up in the 'Network' folder, you'll find that a fairly basic issue is the problem. Check the 'Advanced sharing' settings within 'Network and Sharing Center', and that 'Network discovery' and 'File sharing' are both on. If they are, you may also want to check that 'File and Print Sharing' are enabled in your firewall. The Windows Firewall can seem crazily complex, but check that the 'Private' profile and 'SMB-In/Out' is enabled.

If you're sure everything is connected, functioning correctly, basic settings are set and firewalls have the right ports open, let's delve into the common issues for refusing a share. The most common annoyance is Windows firing up a dialogue stating access can't be established, with an option to diagnose the problem. This can happen in a number of circumstances and the usual issue depends on how you're accessing the remote share.

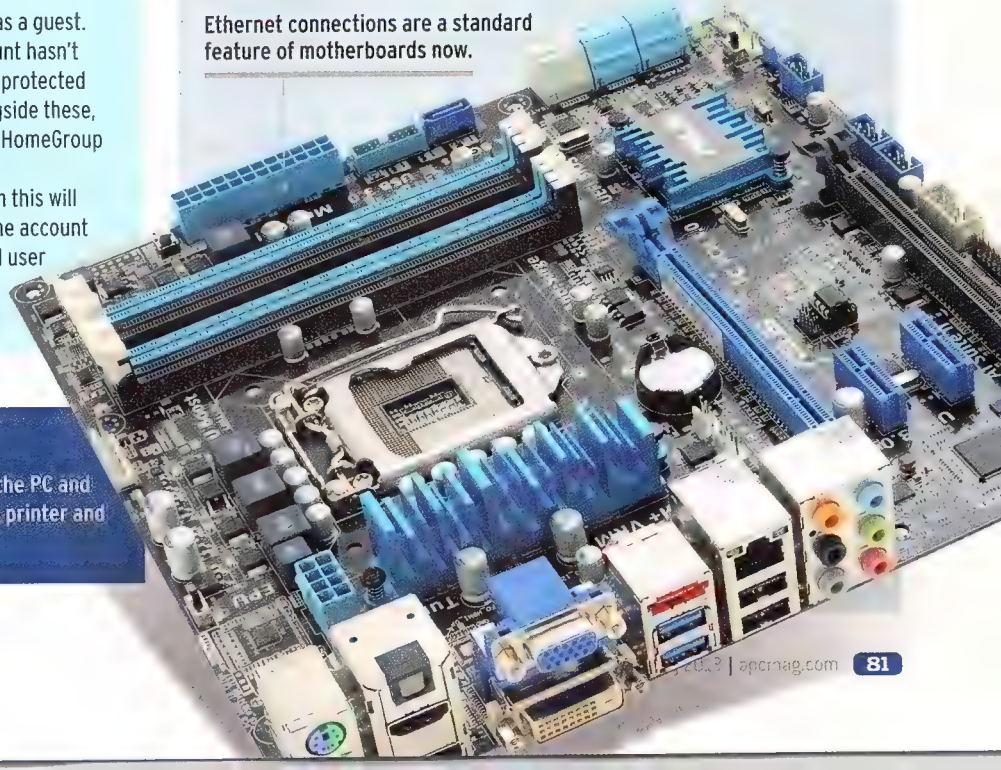
The first scenario is someone just trying to connect to a PC as a guest. The big two reasons for this are that either the guest user account hasn't been created or is disabled. The other is that 'Turn on password protected sharing' is selected, so only registered users can connect. Alongside these, if you're using 'Public' folders, check this option and make sure 'HomeGroup connections' is correctly selected.

The second is if a registered user can't access a system, then this will likely be because the account names don't match correctly or the account is being disabled on the remote system. Similarly, if a registered user can't access a share, but can get on the system, then it's most likely their account has been added to the permissions list.

REMOTE DEKTOP

If you've gone to the trouble of setting up remote user accounts, then it's not much more of a step to enable people with remote control of a PC via the Windows Remote Desktop RDP system. As it turns out, under 'Groups' is a 'Remote Desktop Users' entry. By default, the main user account will have this access already, but you can add any other users to this group to provide them with Remote Desktop access. To do this via the Computer Management Console, select 'Add > Advanced > Find' and select the user. You'll also need to enable Remote Desktop access to the system. The easiest way to do this is to right-click the 'Computer' shortcut, select 'Properties > Advanced system settings > Remote tab' and make sure 'Allow connections' is on. If you're connecting from Windows XP or non-Windows devices, you'll need to select the middle 'Any version' option.

Ethernet connections are a standard feature of motherboards now.



PRINTER SHARES

Once you have a share network you can hang a printer off the PC and set it as shared via the Device and Printers. Right-click the printer and select 'Printer Properties > Sharing tab > Sharing'.

shares. This part is a little confusing because even when it's switched off, all of the HomeGroup interface elements remain visible within Windows. In fact, it's almost like Microsoft adds this stuff without thinking about it.

The final element we'll mention here, as it's not obvious, is if you want mixed access for people with passwords (for secure items) and people you'd like to have guest access without prompts or passwords. For example, we use a shared document folder that anyone can access without the need for a password, while backup folders require a password, so files can't be deleted or removed.

For this type of setup you need to enable the Windows 'Guest' account. There are two ways to do this: one is via the 'Start menu > Control Panel > User Accounts > Add or remove user accounts > Enable Guest Account'. Technically, this can also be activated via the 'Users' section of the Computer Management Console. The 'Guest User' is already created but you need to double-click it and clear the 'Account is disabled' tick box. Once enabled, this in conjunction with the 'Turn off password-protected' sharing, enables guest access to folders marked with guest access privileges.

SHARE & SHARE ALIKE

With your system set up, you're now ready to create password-protected users and enable open-access guest shares, plus password-protected folder shares. We'll go through doing just this in the step-by-step guides in this article, but the password-protected system requires the creation of a suitable user account with a password.

The confusing element here is that the user account you create has to match the same name as the remote system's user account name. Otherwise, you'll find that the remote system will either be limited to guest access or be blocked entirely. This can create the odd situation where if you use the same account name on multiple computers, they'll all have to connect to the network using this same user account.

To add even more confusion to the situation, once you've created the same user-named account, remote users don't have to log on with the same credentials. Instead, you can create a more memorable username and password and that will still work for logging on to a remote share. Ffor example, this could be used when more than one person uses a computer with the same account. The additional credentials enable people that know it to access additional shares. We're sure that there are other usage models that can be applied, but this is the one that springs readily to mind.

Actually enabling the sharing of a folder or drive is a case of selecting the folder in question and using the HomeGroup share system, which is the 'Share with > Specific people' menu option. Here you can add 'Guest' and specific users and then assign read/write permissions.

DOING IT RIGHT

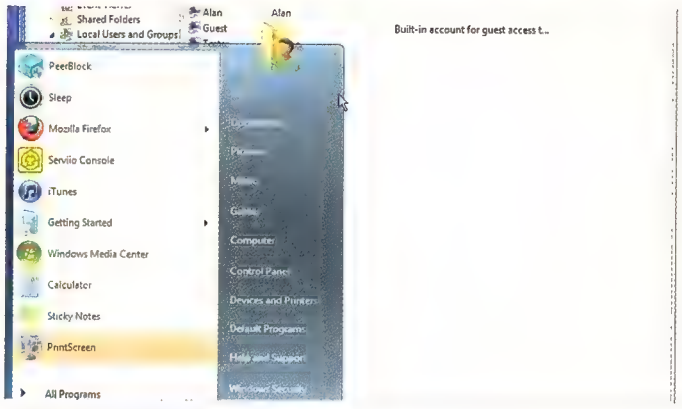
It's worth taking a little time to consider what you want to share over your network and how it can be segregated on the storage your server or PC has. Shares can be nested, so you might password-protect an entire documents folder, but then guest-share a single folder within that for public access; for example, to a photos folder.

Once in place, we think this old school sharing is more straightforward than the contrived HomeGroup with its unnecessary pins and additional interfaces. Having said that, this does work best with a central server to which each networked PC does its sharing. In this case, it means just the one server has to be administered, though even this can be simplified by reusing a single account for access.

In the past, *APC* has covered versatile ways of building your own handy home server using the great-value HP Proliant MicroServer or even making your own from an old laptop – solutions that don't cost much more than $310 including hard drives. You could, of course, use a NAS, but these don't cost much less than a full server solution, which are never as flexible.

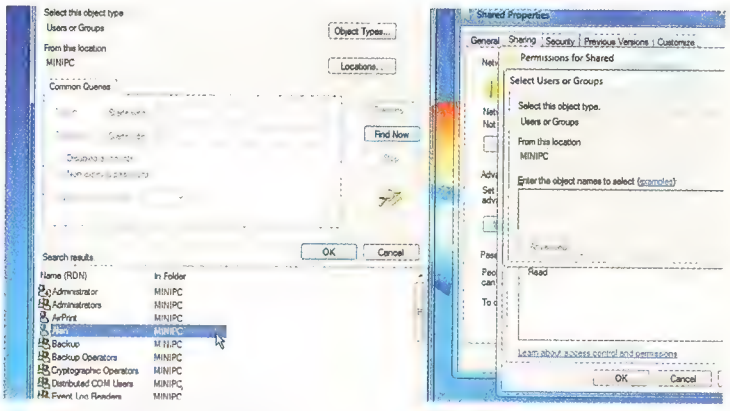
No matter what your approach is, sharing files over your network will only make your life easier. Not only does it offer an easy way to share files everyone wants access to, but it opens up easy routes for backing up, streaming media and providing cloud storage and centralised mass storage that's machine independent. APC

ADVANCED SHARING



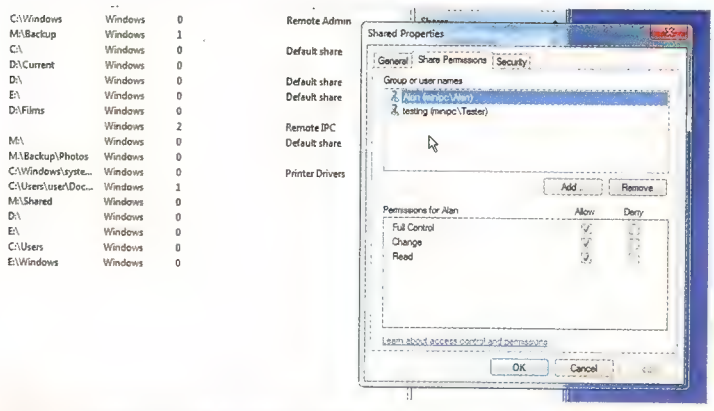
01 CHECK YOUR USER

Before we create a user account, we need to check the remote user account name so they match. The easiest way to do this is to open the 'Start' menu and see the name in the top-right of the menu, or check the 'User' list in the Computer Management Console.



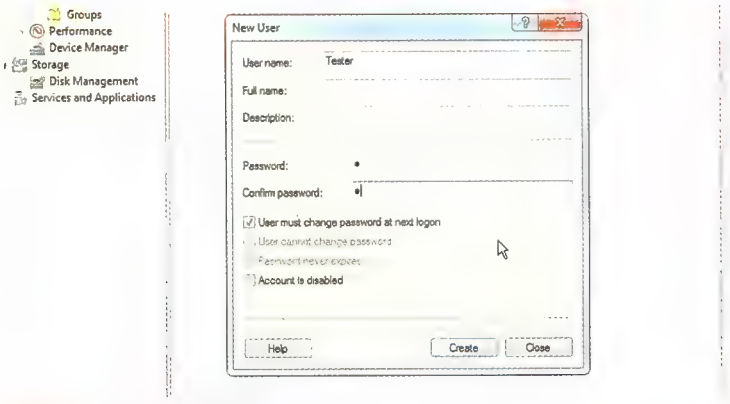
04 USERS & GROUPS

Click 'Permission' and remove 'Everyone', as we don't want that. The next bit is stupid: click 'Add > Object Types', deselect 'Built-in security principles' and click 'OK'. Go to 'Advanced > Find Now'. A list of all the available users and groups will appear.



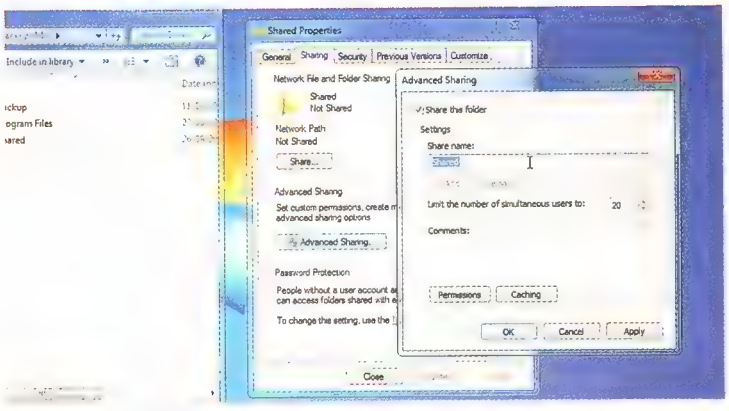
07 COMPUTER MANAGEMENT

Right-click 'Computer' in the 'Start' menu and select 'Manage'. Browse to 'Shared Folders > Shares', double-click the share you created and click the 'Share Permissions' tab. This will list the groups and users you added previously.



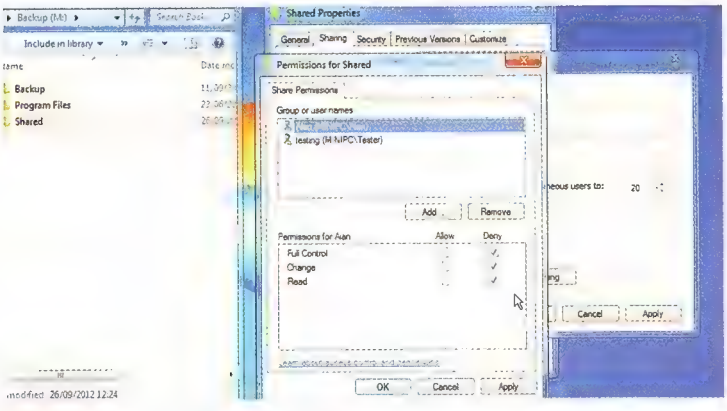
02 USER ACCESS

Armed with the correct username, open the Computer Management Console, go to 'Users', right-click a blank area and select 'New User'. Add this name to the 'Username' and choose a password. Click 'Create' to add this new user to the system.



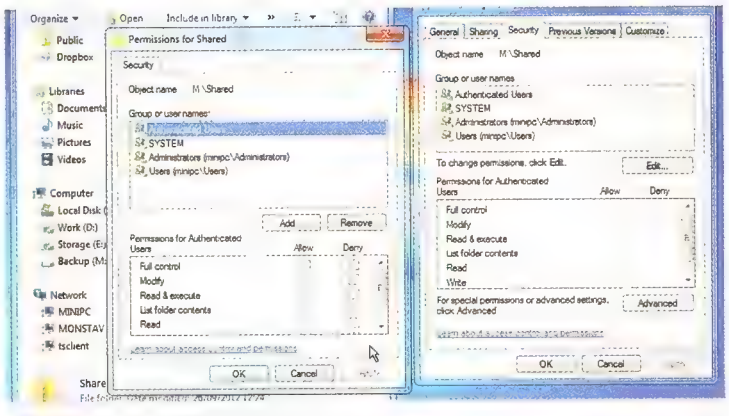
03 COMPLEX SHARING

Create a folder on your drive. Right-click this, select 'Properties > Sharing tab > Advanced Sharing' and click the 'Share this folder' box. You can give this the name that appears within the 'Network' folder and limit the maximum connected users.



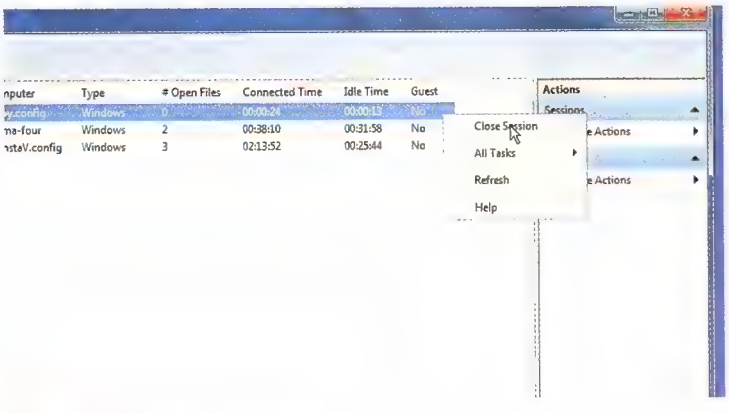
05 ADJUST PERMISSIONS

Select as many users or groups as you want to have access to this share and then click 'OK > OK'. You can adjust the read/write/delete permissions for the folder per user. We never quite understood why 'Deny' exists, but perhaps it's to torment people?



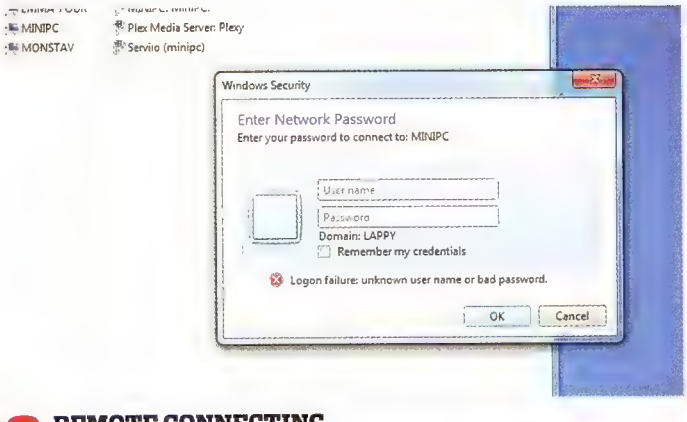
06 SECURITY ISSUES

Click 'OK' followed by 'OK' and the folder will then be shared with the displayed path within the 'Network' folder. The last thing to note here is the 'Security' tab. This can seem confusing, as it appears to duplicate permissions. It does, however, deal with local access rather than network shares.



08 CLOSING SESSIONS

Select the 'Sessions' and 'Open Files' sections, and you'll see lists of the currently connected and active registered users or guests. Right-click a session and you can choose to close it down. Under 'Open Files', 'spools' are printer jobs queued for printing.



09 REMOTE CONNECTING

All that's left to do is remotely log in from your newly registered system. You may need to log them off and back on again if you've changed your password or other details, but otherwise it's a case of entering the username and password you selected.

Experts solve your computing problems

APC and its readers can be one giant helpdesk. If you have a technical problem, chances are one of us can solve it.

WINDOWS

XP OR WINDOWS 7?

Q I am going to be building a new rig in the next month or so and wanted to know what, if any, performance hit I will incur or features I might miss by using Windows XP. I still prefer XP over Windows 7 and have reread your articles on the pros and cons of each. I use Windows 7 at work and on my laptop, but I like XP because I've spent so much time customising it. I have it on my current rig, which is about two years old. It's not the dollars, I'm just sick of the Microsoft ball and chain of having to upgrade for little reason other than some major feature or two. I plan on building an Intel Ivy Bridge rig. I'm not a big gamer anymore, but do want to play on occasion. My main use will be video work: copying, transcoding, a little editing and storing all my movies on my server. Plus audio, mainly MP3s. It's OK if I lose a little bit of performance, but I'm really interested in what features I may miss: USB 3.0 and SATA 6Gbps being my major concerns.
Scott Marion

A Windows XP was a great OS, but its time has passed. Windows 7 is much more secure and (more importantly) is being patched and updated regularly as new vulnerabilities are detected. Also, if you're doing video work, you'll want a 64-bit OS so you can utilise more than 4GB of RAM, and while 64-bit XP was atrocious, 64-bit Windows 7 is excellent. The latter also has better driver support, and many USB 3.0 controllers and SATA 6Gbps controllers don't work in XP. Not to mention, of course, that Windows XP is limited to DirectX 9, so unless you want new games to look like old games, you'll want Windows 7's support for DirectX 10 and 11.

Of course, we could tell you to go for Windows 8 and be even more up-to-date. But it sounds like baby steps are what's needed here. Go for Windows 7. It's a great OS, and there's still plenty of customisation you can do to it. We miss theming XP, too, but not enough to go back.

HARDWARE

FIVE-PIN HEADER

Q I recently built an HTPC with a Lian Li PC-V354A case. I have it paired with an ASUS F1A75-M PRO/C SM motherboard. The Lian Li case has a fantastic front-mounted SD card reader. My problem is that during the build, I realised I have never seen this type of connector before. I don't see a five-pin single-row connector on my board. Did I not properly research my motherboard choice? Am I missing this port? Am I just overlooking it? If I am missing the port, is there an add-on card that I can buy? I'm running an AMD A8-3870K with integrated graphics, so none of the expansion card slots are populated.
Diedrich Guenther

A That's just half of a USB 2.0 internal header. Normally, a USB 2.0 internal header controls two USB ports, so a single set of pins will control one, or in this case, a media card reader. You'll notice one of the five pins isn't populated — that corresponds to the blank pin on the motherboard connector. Plug it into the top or bottom row of one of your motherboard's internal USB connectors (make sure not to plug it into the FireWire connector) and it should be fine.

WINDOWS

SNAPPING BETWEEN MONITORS

Q I use Windows 7 on my laptop and I've got used to using the 'snap' feature to pin windows to the left- or right-hand side of the screen and resize them to fill half the space. I recently added a second monitor to this setup and now my beloved snap has broken. It works on the right-hand side, but when I drag a window to the left it just slides over into the next monitor space. Is there any way to restore the default?
Mark Harrington

DOUBLE TIME: Plugged a second monitor into your laptop? Aero Snap won't work across both screens.

A You can't use the mouse to Aero Snap windows at the boundary between two monitor spaces because there isn't an unambiguous way to tell Windows whether you want the window to snap in place or drag over to the next monitor. However, you can do it with keyboard shortcuts. The Windows key and left arrow will snap a window to the left-hand side of the current screen (or unsnap a window from the right-hand side). If you press it a second time, it will move the window left towards the next monitor space and snap it to the left side of that screen. If you hold Shift and press the down arrow, you'll move the window off to the next monitor space, but your view will stay on your current monitor.

PERIPHERALS

THE TRUTH ABOUT IPS SCREENS

Q I'm a gamer looking to upgrade my old TN screen to a modern day IPS panel. I've been fixated on the ASUS PA238Q after seeing rave reviews. My only concern is that everybody has a different view on what specs this monitor has. I don't really understand the complexities 6ms vs 2ms might pose to fast-paced games like *Call*

of Duty or *Serious Sam*, seeing that this monitor was primarily designed for photo editing. Can you please dumb it down for us simple folk?

Leonard Pretorius

A Well, if I dumb it all the way down to the floor, I'd suggest that IPS isn't really worth the money for a gaming PC. I'll explain why. In-plane switching (IPS) is a different way of arranging the liquid crystal elements and the switching electrodes. It was developed to improve the viewing angle of twisted nematic (TN) LCD screens, particularly the vertical viewing angle, which 10 years ago was completely rubbish. IPS displays also tend to have more accurate colour fidelity and higher contrast ratios, which is why they're preferred by serious photographers.

Viewing angle is a huge deal in a TV screen, but it's virtually irrelevant in a computer monitor. When you're gaming, you sit about 50cm away, completely square to the screen. And you stay there, motionless apart from your fingers, for six hours. If you and two mates sit side by side in front of the screen, the viewing angle of a TN screen is more than enough for everyone to get a great view. Contrast ratio does make a difference, but it's quite subtle and some people care about it more than others. All other things being equal, you'd always choose the monitor with the highest contrast ratio, but all things definitely aren't equal and the extra contrast ratio of IPS screens is balanced by generally slower response times. Even a screen as slow as 8ms is theoretically good enough to cope with 125fps (1 divided by 0.008 is 125), so 6ms versus 2ms ought to be irrelevant, too. However, there's no consistent way of measuring response time between manufacturers, so you have to take the figures quoted on the side of the box with a hefty pinch of salt.

All of this makes it more important to read several hardware reviews of a particular monitor rather than just going by the numbers alone, but personally I'd be more inclined to favour low response times over high contrast ratio numbers. The PA238Q certainly seems to be a very good monitor, but I think you could spend $100 less and have something that was just as good for gaming.

HARDWARE

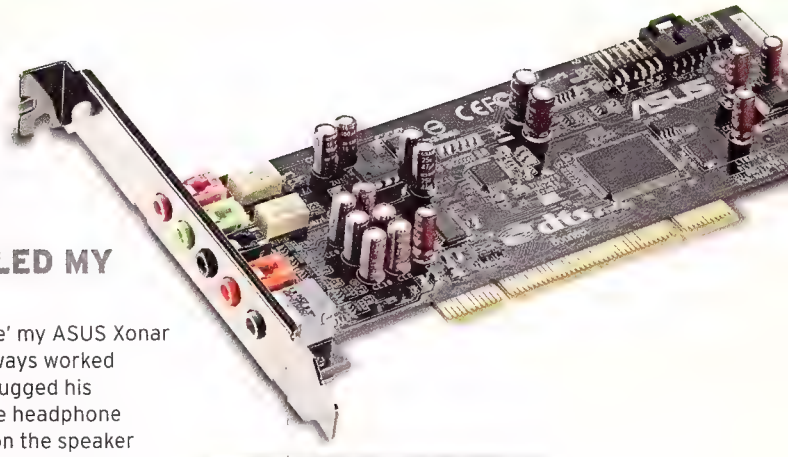
HEADPHONES KILLED MY SOUND CARD

Q My PC can no longer 'see' my ASUS Xonar DS sound card. It has always worked perfectly until my son plugged his earphones in the main PC case headphone socket, instead of the socket on the speaker volume control. I downloaded the latest drivers, but the sound card isn't detected during installation, so it fails. I have tried everything I can think of, but nothing seems to work.

John Adey

A The headphone socket on the case is connected to the onboard sound chip for your motherboard and I expect Windows has just switched to this as the default audio device when it detected the headphones were plugged into that socket. Laptops and a few very fancy desktop motherboards sometimes have a combined stereo jack and optical TOSLINK connector in the same socket. If you see a red light shining out of the headphone jack when you unplug the headphones, it means that dust and gunge have got squished into the back of the socket and activated the physical switch for the optical connection. If this happens, you can clean it with a toothpick or a cotton bud dipped in a little gin or vodka. If there isn't a red light coming out of the headphone socket then this doesn't apply and you can just drink the vodka, so it's win-win.

Try opening 'Control Panel > Sound' and right-clicking your Xonar to change this back to the default. Does that work? If not, shut down, physically remove the sound card from the motherboard, start up again and use Device Manager to remove the Xonar drivers. Shut down again, reinsert the sound card and boot Windows to let it auto-detect the new hardware. If the card isn't detected, then your son and his headphones are red herrings (red 'hearings'?) and the Xonar may just be faulty for different, albeit possibly still son-related, reasons.



D ALERT: If you can see a red light in your headphone socket, try cleaning it with a cotton bud dipped in alcohol.

GRAPHICS

PHYSX ON AMD?

Q I just built a new gaming system a few months back with a Sapphire Radeon HD 7950 GPU. Now that *Borderlands 2* has come out, I'm missing out on all the cool PhysX effects. After doing some research to see if I could still get a standalone PhysX card, I have been hearing of players with AMD cards using Nvidia cards as dedicated PhysX cards for gaming. I was wondering how you would do it and what type of card would be best to use without overheating your system, and killing your PSU.

David Yocabet

A There have indeed been hacked drivers that let owners of AMD GPUs use a secondary Nvidia card as a PhysX card, but they don't seem to have been updated in a while. Fortunately for you, a little config file editing will let you enable physics effects in *Borderlands 2* without using an Nvidia card at all. This doesn't work with most games, so give Gearbox some props for including it.

Go to your Documents folder (in Windows 7, that's C:\Users\username\Documents\) and then go to My Games\Borderlands 2\WillowGame\Config and select 'WillowEngine.ini'. It's a good idea to make a copy of this before you change anything (call it 'WillowEngine.bak' or something). Open the file in Notepad and search for **PhysXLevel** . It will be set to **0** , since you have an AMD GPU. Just change this to **1** (for Low PhysX) or **2** (for High PhysX) and save the file. Launch *Borderlands 2* again and PhysX should be enabled now.

Watch out, though: since you don't have an Nvidia GPU to render PhysX, it all has to be rendered on the CPU side. *Borderlands 2*'s physics effects are pretty heavy, so this can drop your frame rate by quite a bit. You've been warned!

CONTACT@APCTEST.COM Share your tech tips

Have you solved a tech problem or found a better way of doing things with your computer? Share your information with other *APC* readers by sending it in as a tip to contact@apctest.com, together with your name and contact details (details won't be printed). Alternatively, if you have a technical question post it online on our forums at apcmag.com/forums and other readers may be able to solve it.

Windows 8 tips & tricks

Ashton Mills shows you how to tweak Windows 8 to your liking.

YOU'LL NEED THIS

WINDOWS 8
Downloadable from **www.windows.microsoft.com/en-AU**.

WINAERO
Tweaking tools can be downloaded from **www.winaero.com/download.php?list.2**.

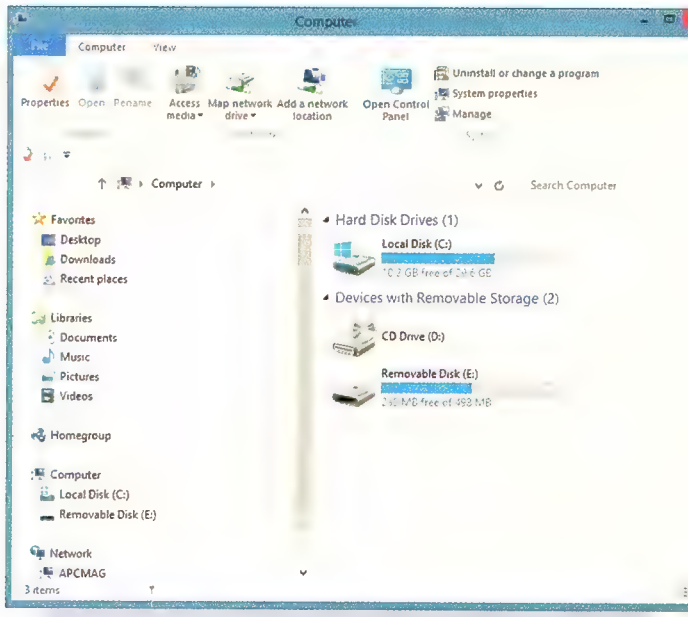
Last month we covered the essential tips and tricks for setting up and using a new Windows 8 install. However, like every Windows version before it, there's more to play with under the bonnet. This month, we're taking a look at some deeper tips and tricks, as well as a few useful tools to change the look and feel of Windows 8.

EXPLORER WITH DRIVES

There are a number of great added features with Explorer in Windows 8, but one of the features removed is the default Explorer view showing all the drives and attached devices in your system; instead, Libraries are now shown by default.

To return to this previous behaviour from Windows 7, first right-click on the Explorer shortcut in the taskbar, then right-click again over 'File Explorer' and select 'Properties'. Now replace the path in the 'Target:' field with: `%SystemRoot%\explorer.exe ,::{20D04FE0-3AEA-1069-A2D8-08002B30309D}` .

Clicking the Explorer icon will then launch Explorer defaulting to the Computer view, listing your drives and other devices. Note the space between `explorer.exe` and `,::{20D0...` above when entering it. Windows won't accept the shortcut without this space.



Restore Explorer to opening with the Computer view by default.

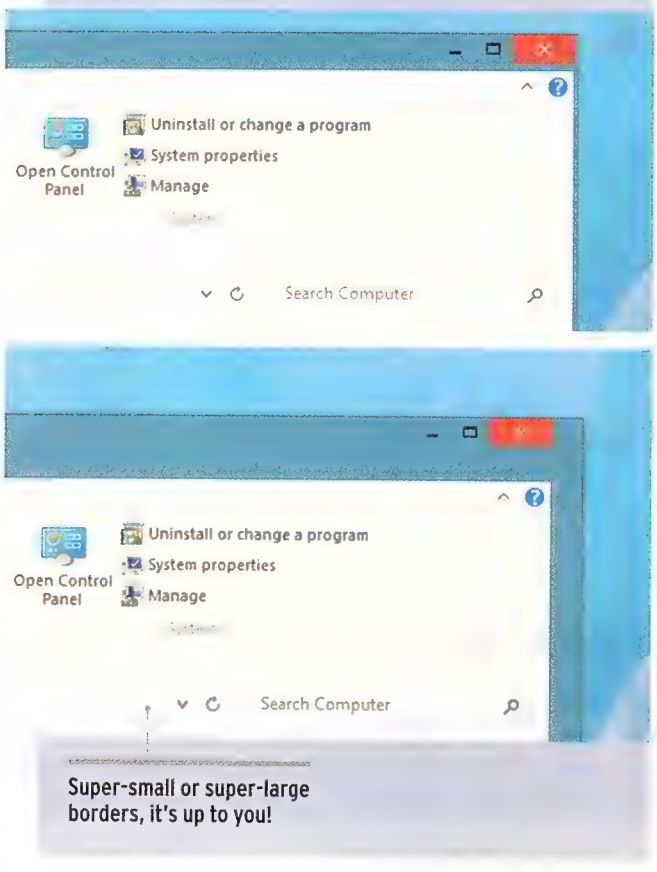
ADJUST BORDER PADDING

My, what thick borders you have Mr Windows 8! And unlike Windows 7, there appears no way to alter this default chunky style. But as always, there's a tweak for that, although this one involves a little registry editing.

First, hover your mouse in the lower-left corner until the 'Start' screen image appears and right-click on it to bring up the Quick Access menu. Select 'Run' and type in `regedit` to launch Windows 8's registry editor.

Browse to the following key: HKEY_CURRENT_USER\Control Panel\Desktop\WindowMetrics. Right-click on 'PaddedBorderWidth', select 'Modify' and type in a new negative value. You can enlarge the border or shrink it, with values closer to zero making it smaller. Set it `0` to disable all padding.

Then log out (choose 'Sign Out' from the username menu in the Modern UI 'Start' screen) and log back in again to trigger the change.



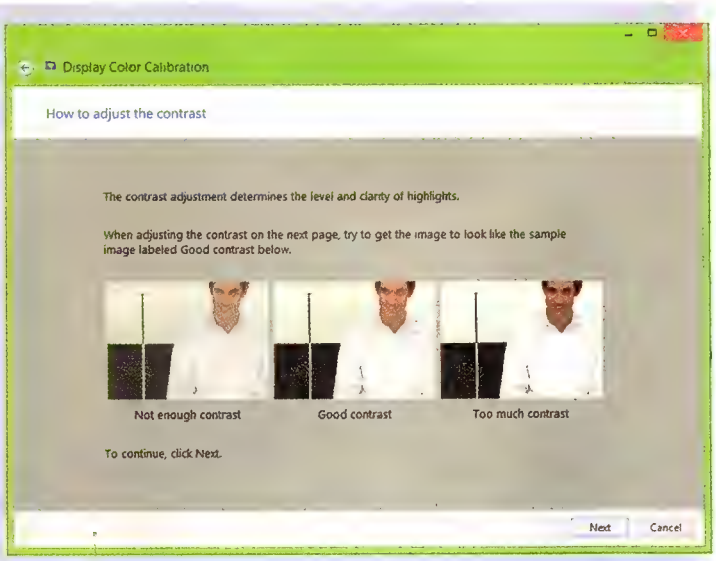
Super-small or super-large borders, it's up to you!

CALIBRATE YOUR DISPLAY

Windows has had an in-built display calibration tool for some time now, but it's not easily found. Even searching in Windows 8 for 'display' or 'calibrate' turns up nothing. The handy tool is still there, though it's almost like you need to know the secret password to get to it. In this case, this is 'dccw'. Search for this in the Modern UI search to launch the Display Colour Calibration tool and calibrate Windows for your monitor. This includes adjusting brightness, contrast and RGB balance, and ends with being able to tweak ClearType if you so desire to improve the look of font rendering on the screen.

STARTING IN SAFE MODE

Starting in Safe Mode used to be as easy as pressing (or rather, button mashing) F8 at startup to interrupt the boot


Display Color Calibration
How to adjust the contrast
The contrast adjustment determines the level and clarity of highlights.
When adjusting the contrast on the next page, try to get the image to look like the sample image labeled Good contrast below.
Not enough contrast
Good contrast
Too much contrast
To continue, click Next.
Next
Cancel

Basic screen calibration can be achieved with Windows' built-in tool.

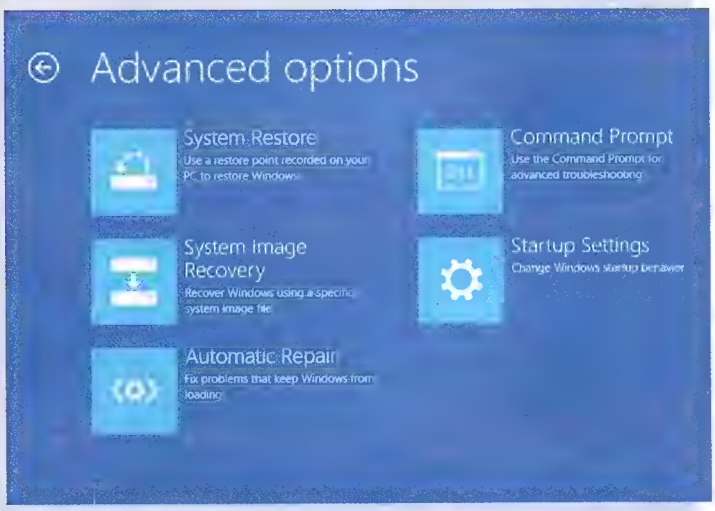
DISABLE DYNAMIC TICKS

While Linux has had dynamic ticks for some eight years now, Windows 8 is the first version of Windows to incorporate it. And it's not working out so well.

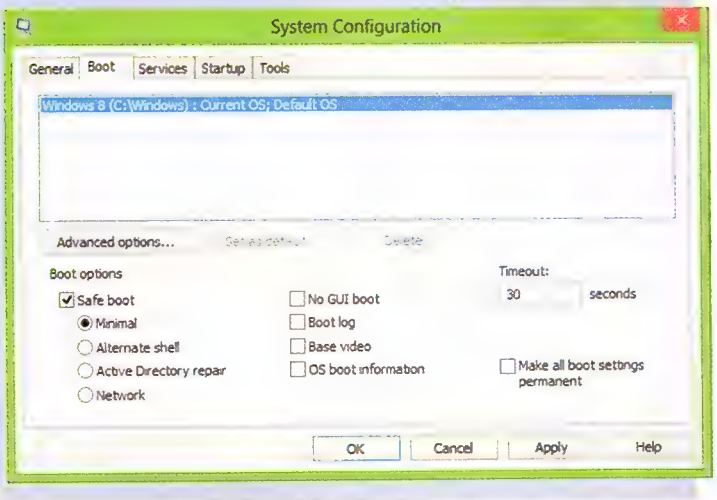
On the whole, dynamic ticks are a good thing, altering the timer interrupt on a system to only occur as processor events need to be triggered. The upshot of this is the processor gets to spend more time idling, which in turn saves power. On a desktop this isn't so noticeable, but on mobile devices such as laptops and tablets, this can add up to a significant saving in battery life.

Unfortunately, with Microsoft's implementation in the Windows 8 kernel it's been causing problems, with numerous reports online of random freezing of the OS. There's still been no official word from Microsoft on the cause, but it's thought to be related to drivers crashing the system — since many drivers are designed to perform a job at regular intervals (for example, updating your screen with your GPU), adjusting to dynamic interrupts appears to be causing problems with some hardware.

If you've been experiencing random freezes, particularly if leaving the machine idle for a while, the solution may be to disable dynamic ticks. To do so, first launch an elevated command prompt ('Command Prompt (Admin)' from the Quick Access menu) and run: `bcdedit /set disabledynamictick yes` . Then reboot.


Advanced options
System Restore
Use a restore point recorded on your PC to restore Windows
Command Prompt
Use the Command Prompt for advanced troubleshooting
System Image Recovery
Recover Windows using a specific system image file
Startup Settings
Change Windows startup behavior
Automatic Repair
Fix problems that keep Windows from loading

Safe Mode is buried under 'Startup Settings'.



Setting to reboot in Safe Mode.

Add your Steam games to the Modern UI 'Start' screen.

process and choosing to boot into Safe Mode. Windows 8 makes this no more, but Safe Mode is still there. It's just a little bit more convoluted to get to.

The long method is to get there via the 'Advanced Startup' screen (also called the 'Recovery Screen'). This can be entered by bringing up the Charms bar and heading to 'Settings > Change PC Settings > General'. From here, click 'Restart Now' under 'Advanced Startup'. Once there, you need to click 'Troubleshoot > Advanced Options > Startup Settings'. And then you need to restart again.

The quick method is to bring up the Quick Access menu (right-click in the lower-left corner on the desktop), select 'Run' and type **msconfig** . From here, click the 'Boot' tab and tick 'Safe Boot'. When you reboot, you'll reboot to Safe Mode. However, note that you then need run **msconfig** again and deselect 'Safe Boot', otherwise you'll keeping booting to Safe Mode.

ADD STEAM GAMES TO THE MODERN UI

If you're a gamer, you're familiar with Steam. While installing Steam on Windows 8 will add an icon for it to the Modern UI's 'Start' screen, you still can't launch games from there. This is easily fixed with a little file shortcut wizardry (or hack, depending how you look at it).

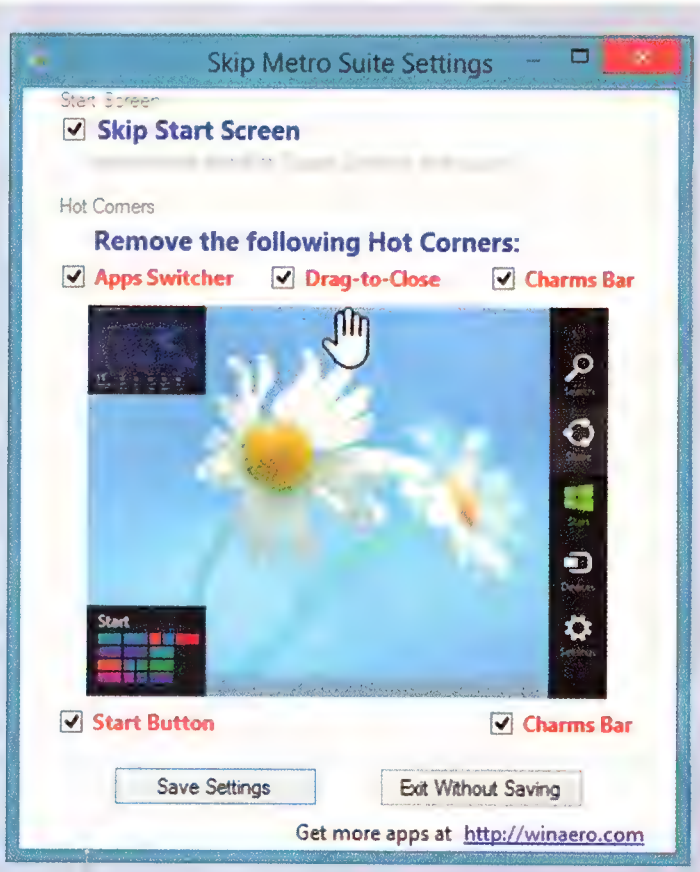
First, create shortcuts for any games you want to add to the Modern UI 'Start' screen from Steam itself. This is usually done by going to your

Library in Steam, right-clicking on a game and selecting 'Create Desktop Shortcut'. Move the shortcuts to C:\Users\username\AppData\Roaming\Microsoft\Windows\Start Menu\Programs\. If the AppData directory isn't visible for you, simply click on the 'View' tab at the top in Explorer, followed by ticking the 'Hidden items' box. Finally, head into the Modern UI, bring up the Charms bar and click on 'Search'. Type in the name of the game shortcut you want to pin and it will show up as a search result. Now you can simply right-click on it and select 'Pin to Start'.

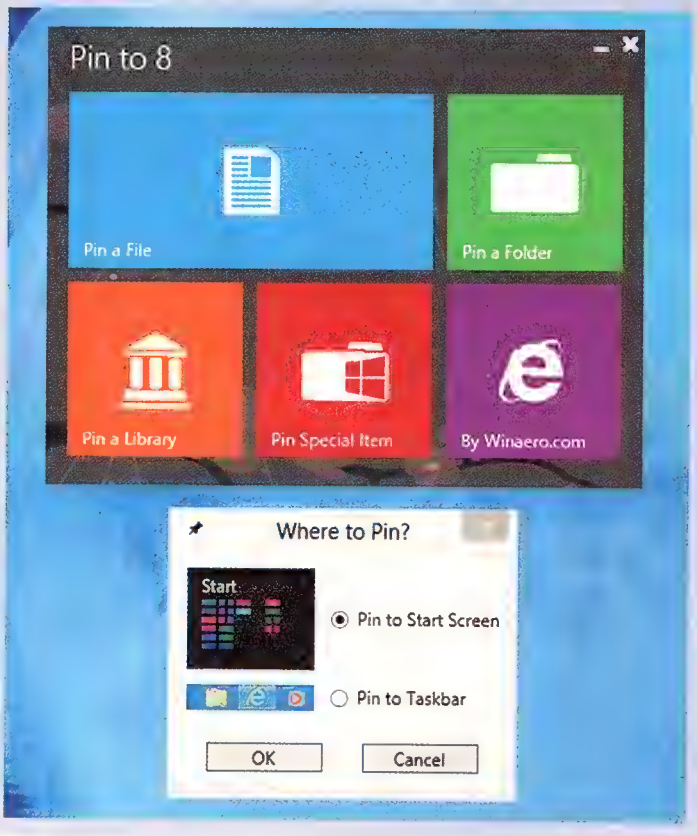
WINAERO TOOLS

We're not usually fans of tweak tools, but these three programs are neatly packaged and focused to help you change the behaviour of Windows 8. All of them are from the WinAero site, the download pages for which are unfortunately littered with junk advertising — you'll have to navigate past multiple false 'DOWNLOAD!' buttons to get the one that actually gives you the file.

- Skip Metro Suite (**winaero.com/download.php?view.33**). This is an excellent tool to complete your exodus from the Modern UI desktop, should you so choose. It features a 'Skip Start Screen' toggle to let you boot directly to the desktop, something other tools have offered, including the 'Start' menu replacements Classic Shell (**classicshell.sourceforge.net**), Start 8 (**www.stardock.com/products/start8**) and ViStart (**lee-soft.com/vistart**) we looked at in previous issues. However, unique to this suite are the options to disable Windows 8's hot corners that bring up the app switcher, 'Start' screen button and, of course, the Charms bar. Technically, if you tick all the boxes and install a 'Start' menu replacement, you can boot to Windows 8 and never see the Modern UI or any of its ancillary functions at all. This is the closest to a pure Windows 7 desktop you can get.
- Pin to 8 (**winaero.com/download.php?view.36**). This simple tool takes a different tack: assuming you do like the Modern UI, it helps to make better use of it by letting you pin pretty much anything to the 'Start' screen. Alternatively, it does the same for the taskbar in the desktop, too. This includes being able to pin folders, libraries ('Music', 'Movies' or 'Documents'), individual files (such as a Word document) and finally, 'Special items'. For the latter there's a wide selection to choose from including the 'Control Panel', 'Network', 'Power Options', 'Recycle Bin' and even the 'Run' dialogue.
- Start Screen Animations Tweaker (**winaero.com/download.php?view.37**). This tool is for people who *really* love the Modern UI. So much, in fact, that they wouldn't mind spending a little extra time marvelling at its slick 'Start' screen animations, where tiles, the user picture and username slide into view depending on the values you set. To give it a quick spin, try the 'Recommended settings' button followed by 'Apply', and then return to the 'Start' screen. If you really like the full-length intro animation — seen when you first log in — to occur every time the 'Start' screen appears, there's even an easy toggle option for that in the tool as well.

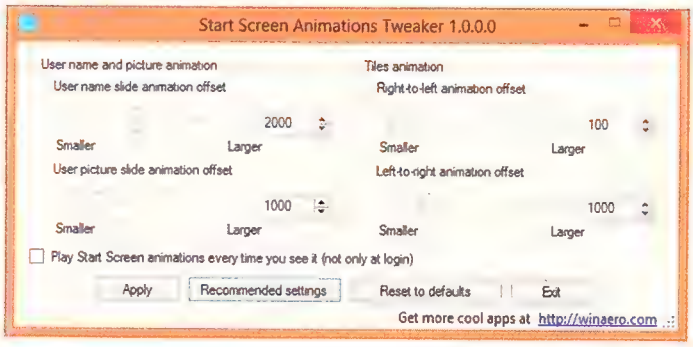


The ultimate tool in ridding yourself of the vestiges of the Modern UI.



Pin to 8 makes it easy to add files, folders and special objects to the Modern UI or the taskbar.

If you really like the Modern UI, you can tweak the 'Start' screen animations.



apc

NEW iPAD MINI: SAME SAUSAGE DIFFERENT LENGTH
apc
WINDOWS 8 IS HERE!
THE FIRST HARDWARE
INSIDE THE WINDOWS STORE
LICENSING EXPLAINED
LOW-COST PC CRAZE
HOW TO BUILD A SUB-$100 ANDROID PC
WiFi & TV CLOUD STICK
MK802
ANDROID 4.0 MINI PC
LABS
NAS COMPARISON
Need serious storage? We have eight pages of top-flight NAS boxes
MASTERCLASSES
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Going from simple forms to more sophisticated user interfaces
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Full HD quality encoding

Drop no frames, lose no quality. Neil Mohr takes encoding up a level.

YOU'LL NEED THIS

MULTI-CORE CPU

There's no denying that encoding high-quality video takes a lot of time. Using a multi-core AMD or Intel processor is going to help a lot. The more cores the better and if you can leverage Intel Quick Sync Video, then so much the better.

SOFTWARE

We'll be using seven or eight interdependent tools for this project. It sounds like a lot and it is. Jump in to the first guide on page 91, as we'll cover most of it there. Most of the tools are open source and were developed for this one task, which means they're not exactly polished.

ECLIPSE

This free, open-source Java programming environment can be found at **www.eclipse.org**.

Desktop PCs today are saturated with video. It floods in from all ports and the scary thing is, the machines seem to take the punishment with ease. Where once we were thrilled to see a quarter-screen VGA video streamed from a CD, we now tut and roll our eyes if YouTube can't offer 1080p, leaving our eyeballs to endure mere 720p.

With all of this video pouring into your PC, when it comes to storing something — be it a phone clip or a rip from a disc — how do you ensure you get the best possible quality? You could use one of the many one-click style solutions (like MediaEspresso), which support Intel's Quick Sync Video. We're even going to recommend a free one that does a fabulous job of supporting almost any device — see the 'One click is enough' box below.

But we're not going to take that easy route. We're going to look at how serious HD video fiends encode their video. It might not be fast, but it's very clever. Along the way we'll cover downscaling for best effect and how to store HD video in a small package that retains all the perceivable detail of the original HD footage.

CONTAIN YOURSELF

Before going into encoding in detail, it's important to know your containers from your codecs. You can skip ahead if you're up to speed, but here's a quick rundown of the ones you'll encounter.

A container is a special file format that combines multiple files into a single one. For video, this is usually a video stream and audio stream, but it can include multiple audio, subtitles and other types on top. The most common containers are MKV, AVI, MP4, WMV and TS.

MKV: Matroska, widely used online and designed to contain anything.

AVI: Audio Video Interleave, expanded to support DIVX/XVID without subtitles.

MP4: The official H.264 container designed to handle H.264, MPEG-2 and DIVX/XVID.

WMV: Microsoft's container only supports WMV with WMA.

TS: Transport Stream, which is used by broadcasters and usually uses H.264 video.

The second part of the equation is codecs — the system used to encode the audio and video streams. The terms used here can get confusing, largely because a number of terms mean the same thing and therefore end up being interchanged. We'll mention audio now, as there's old school MP3, Dolby Digital (aka AC-3), the rarer DTS and finally, the best choice of AAC.

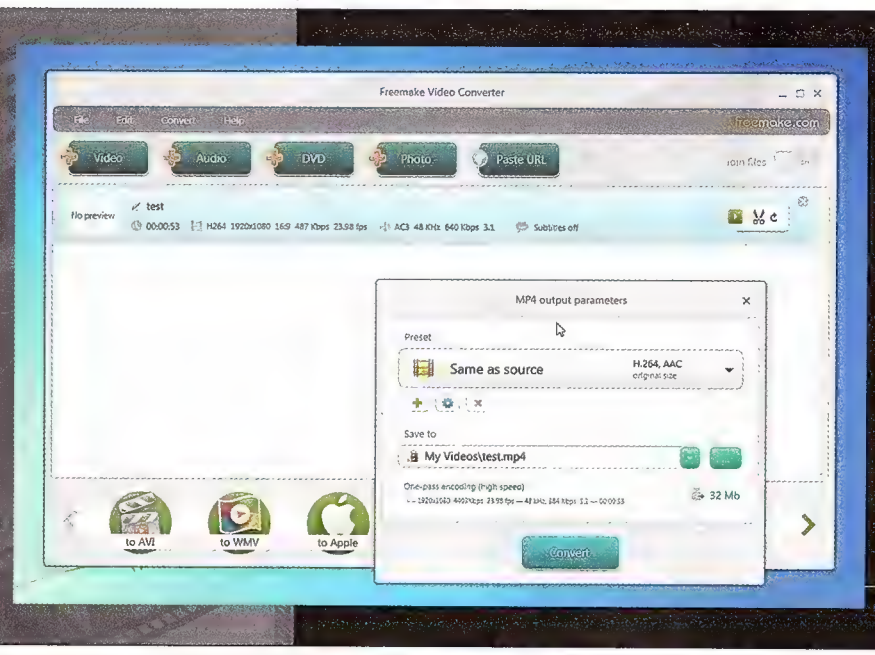
AAC: A more recent standard that looks similar to AC-3 on paper, but is superior at the same bit rates. There are a number of lossless audio formats based on DTS and AC-3, but we won't cover those here.

H.264: An HD video standard that's used by most broadcasters. x264 is identical but is the open-source encoder, so files produced with this typically take x264 as their format. AVC — also known as MP4 Part 10 or MP4 AVC — is the same.

DivX: A closed-source implementation of the MP4 standard.

32- VS 64-BIT

Codecs are already behind the times in regards to 64-bit. It's vital when downloading utilities, codecs and so on that they're all 32-bit or 64-bit. We recommend sticking with 32-bit.



You can take the easy route if you prefer.

ONE CLICK IS ENOUGH

We fully understand if the complex array of tools and settings we've gone through here is too much palaver. Sometimes you just want to encode your file and go, without worrying about whether you've built a graph file correctly (whatever that is).

For these jobs, we highly recommend Freemake Video Converter from **www.freemake.com**. When you're installing the program, be careful to avoid all the junk – that's how the developer can offer such a professional package for free.

We've looked at Freemake in the past. With support for GPGPU and the like, it offers advanced features you'd expect from commercial software. It makes encoding incredibly fast, too.

It not only supports default file formats for all your devices, it can also handle creating video for YouTube and transferring to Blu-ray and DVDs with a long-play option of up to 40 hours. It's the best one-click video converting solution available.

JARGON BUSTER

Mux. Short for multiplexing or the combining of two or more streams, usually audio and video.

Deblocking. The encoding system can produce block artefacts under stress; deblocking attempts to eliminate these.

Bit rate. The number of bits per second used to encode a video or audio stream. We'll be using a variable bit rate.

An open-source-compatible format called XVID was developed. It's similar to H.264.

MPEG-2: Used for DVD encoding and HD broadcasts in the US as part of a .TS file.

VC-1: The video format used on the defunct HD DVD format and also Microsoft WMV9.

SWISS ARMY EDITING

For this tutorial we're leaning heavily on the amateur world of HD video encoding — the type of everyday genius-level guys who write the x264 encoder, ffdshow, Haali Media Splitter and all the rest. The only problem is this involves using a lot of disparate complex tools to generate professional encoding results.

To begin, follow the step-by-step guide right to get the tools downloaded, installed and configured correctly. We'll then use the second walkthrough to output a high-quality encode. Using this you should be able to produce a pro-quality encode at any standard size you want. The final element is adding the audio stream back into the encoded video, but for technical reasons this has to be handled separately. The options for this are to remix the original audio into the new file or take a re-encoded version, which may or may not be ideal for you.

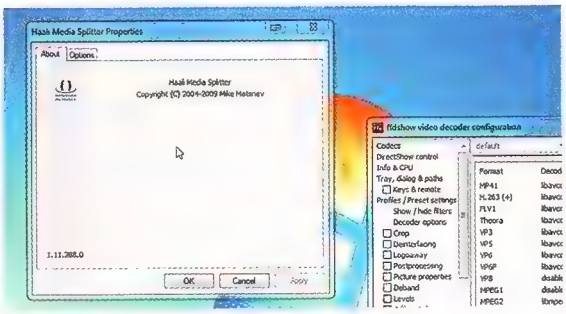
The oddest part of this process is the initial graph creation and script writing. It's confusing because it seems unnecessary at first, and yes, it's true that you could just feed the original files directly to MeGUI. The point of creating the graph is to ensure you're using the right codec to decode the video source — and so retain full quality — rather than just any old codec that Windows chooses. If you drop the video file into GraphStudio, you'll see that it will pick a different codec. The scripting element also seems overly complex, but it's connected to using the 'c' tool, which processes the video and audio streams and is used to tie a number of the encoding tools together.

MEGUI AVS CUTTER

Don't encode an entire film. In the MeGUI 'Tools' menu you'll find 'AVS Cutter'. This lets you select a range of frames and just encode those. Pick an action scene to test your encode.

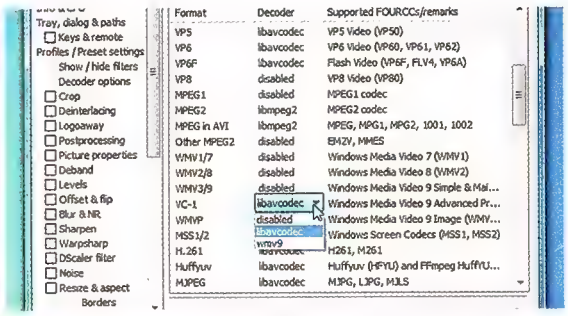
FILTERS, MUXERS & CODECS

There never was so much downloading and installing.



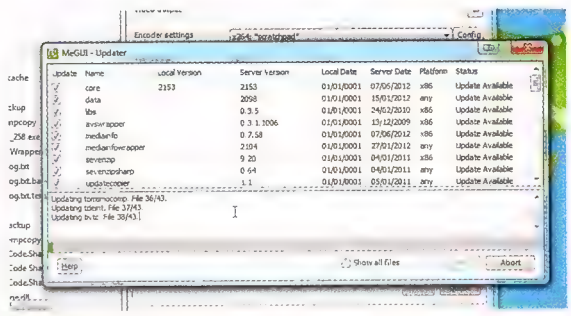
01 VIDEO KILLED EVERYONE

You may have heard of ffdshow and Haali already. You might have them as part of the CCCP distribution, but you'll need to get them again as standalone installs. Opt for 32-bit versions. ffdshow is from **tinyurl.com/3ynurk**, while Haali Media Splitter, also known as Matroska Splitter, is available from **www.haali.su/mkv**. While you're at it, also grab AviSynth from **www.avisynth.org/mediawiki**.



02 CONFIGURE SETTINGS

ffdshow needs a couple of decoding settings defining. Select 'Start > All Programs > ffdshow > Video Decoder Settings'. Look under the 'Default Codec' section and find 'MPEG-2'. Set 'Decoder' to 'libmpeg2' and 'VC-1' to 'libavcodec'. This ensures everything you might encounter in this guide is covered. Finally, download AvsP from **tinyurl.com/2ygb4r** and extract it. We'll need it later.

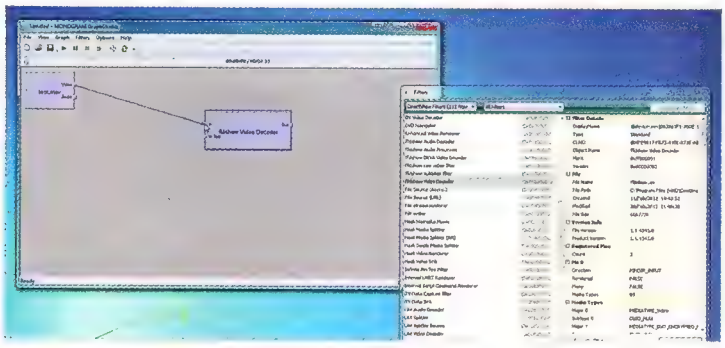


03 MEGUI UPDATES

The de facto encoding tool at the moment is MeGUI, which is based on a comprehensive encoding tool called MEncoder. You can grab this from **sourceforge.net/projects/megui**. We suggest you extract and run 'MeGUI.exe', as it'll need to update itself, which can take a little while. The last piece of the puzzle is GraphStudio. Download it from **tinyurl.com/d5me8c3** and extract it.

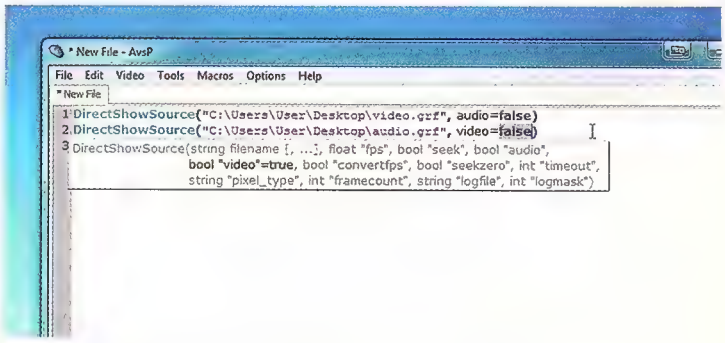
IS THIS ENCODING?

Got your software? Good, now prepare to get very confused...



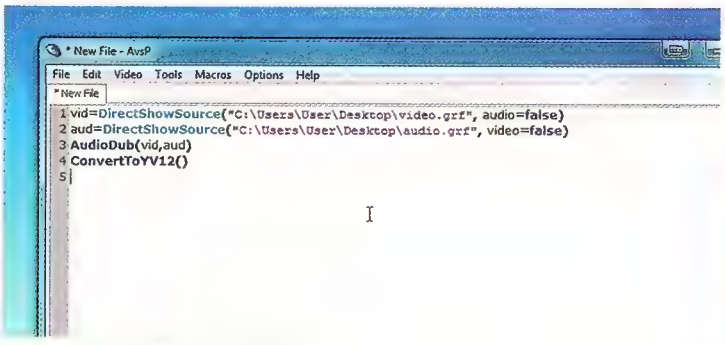
01 GET GRAPHING

Fire up GraphStudio, which is a complex bit of DirectShow. Select 'Graph > Insert Filter' under the default 'DirectShow' selection, then double-click 'Haali Media Splitter', click 'Browse' and select your video. Repeat the process, but double-click 'ffdshow Video Decoder'. Two boxes will then be displayed in the window. Use your mouse to drag a line from the file's 'Video' pin to the ffdshowhow 'In' pin.


* New File - AvsP
File Edit Video Tools Macros Options Help
* New File
1 DirectShowSource("C:\Users\User\Desktop\video.grf", audio=false)
2 DirectShowSource("C:\Users\User\Desktop\audio.grf", video=false)
3 DirectShowSource(string filename [, ...], float "fps", bool "seek", bool "audio",
bool "video"=true, bool "convertfps", bool "seekzero", int "timeout",
string "pixel_type", int "framecount", string "logfile", int "logmask")

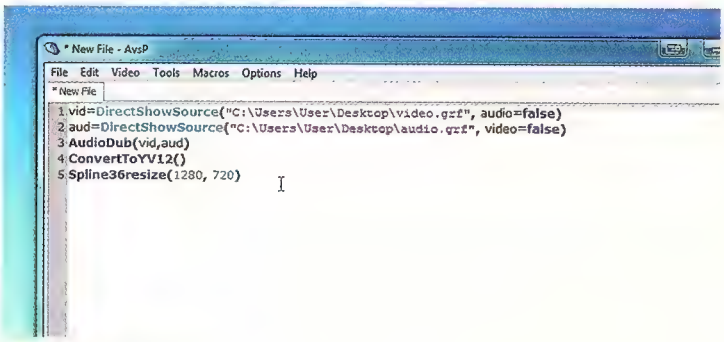
02 GRAPHS & SCRIPTS

Select 'File > Save graph (.GRF)' and name it `video.grf` . Delete the two boxes and repeat the whole process, but select 'ffsshow Audio Decoder' and name the graph file `audio.grf` . Start AvsP and then drag the video.grf and audio.grf files to the AvsP window individually. Just before each closing bracket, add `audio=false` to the video line and `video=false` to the audio.



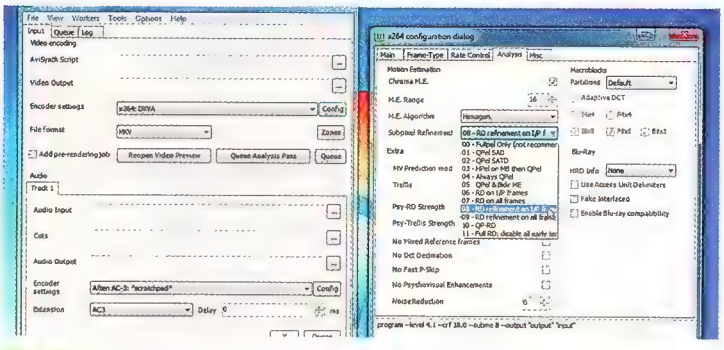
03 WRITE THE SCRIPT

At the start of the first line add `vid=` . Add `aud=` to the start of the second line and on the third line, add `AudioDub(vid,aud)` . On the next line also add `ConvertToYV12()` , which adjusts the colour space. We're building a script here that AviSynth will run, which is why it seems like programming. Technically we just need the video, but having the audio included can be handy.



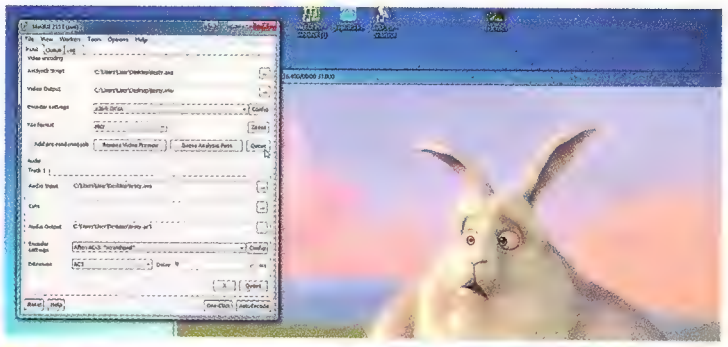
04 RESIZE ME

The script can resize the video to anything you like. Add the line `Spline36resize(x , y)` , with `x` being the new width and `y` the new height. After cropping, if the width remains 1,920 you can calculate the new height with this equation: `(cropped.height/1,920) * 1,280` . Round the number to the nearest whole pixel and you should have an aspect-correct image.



05 GO GUI

Save the script and fire up MeGUI. This is a complex front end for the x264 encoder. Under 'Encoder Settings', make sure 'x264' is set and click 'Config'. Set 'AVC Level' as 'Level 4.1', 'Encoding Mode' as 'Const' and 'Quality' between 18 and 21, 18 being best. Tick 'Show Advanced Setting > Analysis' and set 'Subpixel refinement' to 08.

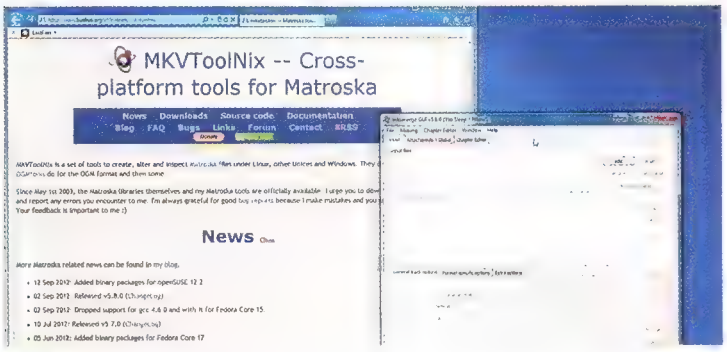


06 TWIDDLE YOUR THUMBS

Set 'File Format' to 'MKV' and drag your AVS script to the top 'AviSynth Script' box. Check the video output location and name, and see the 'MeGUI AVS Cutter' tip on page 91 for how to test a short clip. Click the top 'Queue' button to encode the video and use the bottom button to encode the audio. The video will lack audio – see the next guide to fix that.

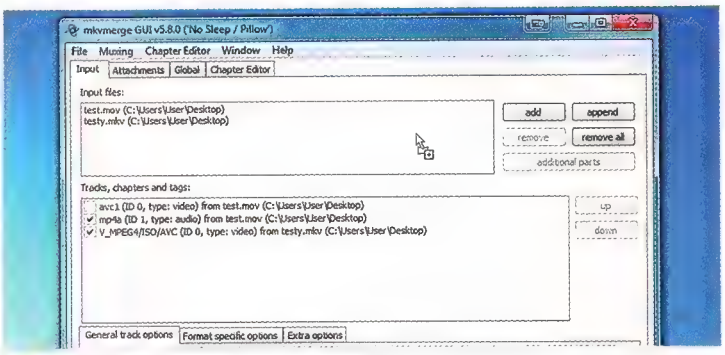
GETTING IN A MUX

It's time to add the audio back in. Sound good?



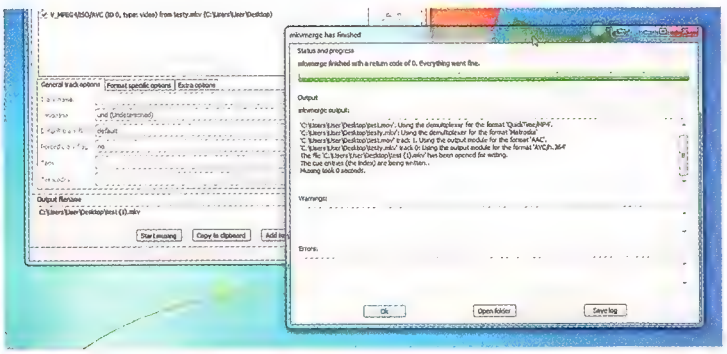
01 YET ANOTHER TOOL

Let us introduce you to MKVToolnix, which you can download and install from **tinyurl.com/a6plj**. This tool will enable you to extract and combine all manner of streams within any number of container files. Our aim here is to take the old video's audio and then add it to the new encoded file. This is called muxing. Open the 'Start' menu and find 'mkvmerge GUI'.



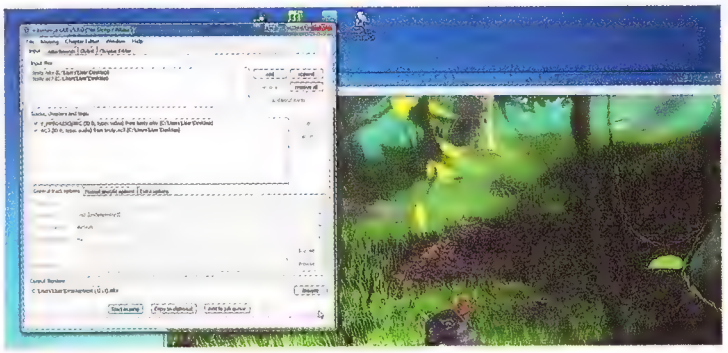
02 CROSS THE STREAMS

The muxing process is straightforward: you just need to add the files to the 'Input Files' section at the top of the screen. As you do this, the various tracks and elements contained within them are displayed as a whole below. Once you've added the two files, deselect everything, then select the video stream from your new .MKV file and the audio track from the original file.



03 MUXING AROUND

Enter a final output filename and location in the bottom box and then click 'Start muxing' to generate the final file. It shouldn't take long. Once it's finished, test the file and make sure the audio syncs correctly – skip near to the end of the video to check. There can be slight discrepancies, in which case you might want to use the next step and mux in the remixed audio.



04 USING AUDIO TRACKS

Despite its name, this package doesn't just handle .MKV files – it's possible to add a huge range of audio tracks to the 'Input Files' section, from AC-3 and AAC to the various DTS tracks. These can then be muxed into the encoded video file. If you're taking this track from MeGUI, then you can be sure that its timing is exactly the same as the encoded video track.

JUST THE BASICS

If you thought all that was complicated enough then prepare to be terrified – we haven't even scratched the surface of video encoding here! In fact, we've probably taken a couple of shortcuts to keep this tutorial as slimmed down as possible.

The authoring tools used in this tutorial match those offered by professional systems. This means there's a wealth of options at your fingertips, but we've provided the core standards here so you can output video at nearly the best possible quality and retain DXVA compatibility without having to mess around with settings and options too much.

For example, we skipped over the handy subject of cropping. Adding the line `(0,0,-0,0)` to the AVS script crops out black bars. The numbers here refer to the number of pixels to be cropped from the left, top right and bottom. To confuse matters, the remaining number of pixels needs to be divisible by 16 without leaving a remainder, so adjust the crop amount (usually upwards) to suit if required.

We're happy to admit that this route isn't the fastest by any means. In fact, it's pretty darn slow, but quality is the key here, not speed. If you're after speed, check out Freemake Video Converter, which can hammer through conversions in a matter of seconds. Bizarrely, this high-end x264 encoding tool – despite supporting as many cores as you can throw at it – actually degrades the encoding quality as the number of threads increases.

If you take time to check out the sites some of these tools are taken from, you'll find out just how versatile this system is for encoding video. As long as you have the audio, video and subtitle files on your system, you'll be able to encode and mux them together at any resolution, in almost any format that takes your fancy. If the source is of a sufficiently high quality then you can be guaranteed a crystal-clear encode.

Best friends forever?

Well, maybe not, but we can at least get Windows 8 and Linux booting from the same machine without too much trouble. Ashton Mills explains.

YOU'LL NEED THIS

WINDOWS 8

To dual-boot Win 8 and Linux, you'll first need Win 8 (duh). Download it from **windows.microsoft.com/en-AU**.

LINUX

Get the Ubuntu Linux 12.10 OS from **www.ubuntu.com**.

To its credit, Windows 8 adds much more than just the Modern UI. There's the underlying changes for memory efficiency, graphics performance (particularly elements like images, for which the Modern UI heavily relies on) and of course, the range of system-wide improvements like more informative copy dialogues and the ever-so-sexy Task Manager.

It also revamped, for the first time, both the dreaded BSOD screen and in many ways, its reluctant partner: the Windows boot manager. Under the bonnet the Windows boot manager works much the same as it did in Windows 7, with the added difference that's it's a heck of a lot nicer to look at. No longer are you presented with merely an ASCII-based white-on-black boot menu, much like GRUB for Linux; instead, there's a soft blue background with large icons and fonts that mimic the Modern UI — and it's mouse driven to boot (HA! See what I did there?). Such that, for some of us here at *APC*, we actually prefer the look of Windows 8's boot manager than the traditional Linux one, even if slightly prettified in distributions like Ubuntu.

So, while you can easily set up a dual-boot system by installing Windows 8 first and then Linux, you'll be left with GRUB to manage your boot. If you prefer the look of the Windows 8 menu, here's how to dual-boot Windows 8 and Linux using the Windows 8 boot manager.

STEP 1: INSTALLATION ORDER

Installing Windows 8 and Linux on the same system doesn't change — always do Windows first and then Linux second. However, the only difference now is to install GRUB to the root partition (or a /boot partition, if you set one up) instead of the MBR of the hard drive. For example, you might configure your installation to look something like the diagram below.

When you do this, you initially won't be able to boot to Linux once the installation finishes. This is fine, as we'll fix that in a moment.

STEP 2: INSTALL EASYBCD

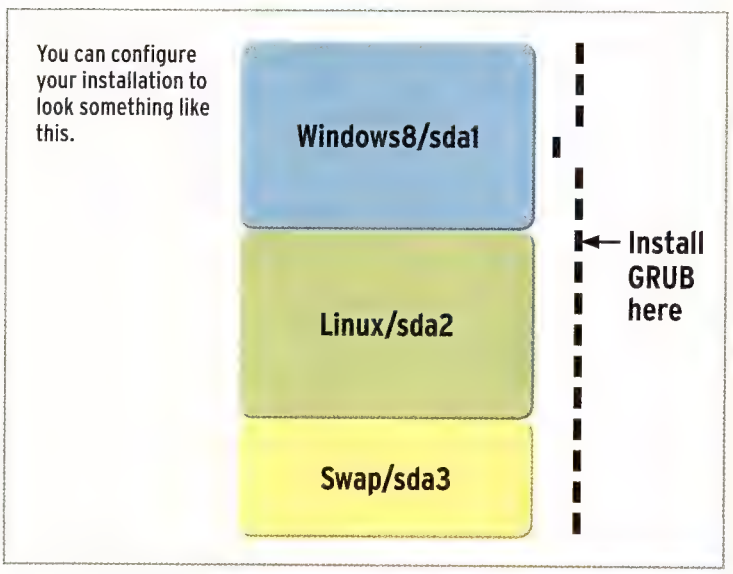
Reboot and once Windows 8 has loaded, drop to the desktop and head to **neosmart.net/EasyBCD**. Click on 'Register' at the bottom of the page and optionally fill in your details if you'd like to help support EasyBCD. This isn't necessary, though, and you can click 'Download!' to download EasyBCD whether you register or not.

EasyBCD has been around for some time and provides flexible control over the Windows Boot Configuration Data (BCD). This includes the boot menu, for which Windows is actually quite a capable tool. It'll happily boot a range of Windows operating systems and much like GRUB, it can be configured to chain-load non-Microsoft operating systems — with a little help, anyway. One of the features of EasyBCD is the integration of both a GRUB boot image and GRUB chain-loader, allowing you to boot Linux from the Windows boot menu.

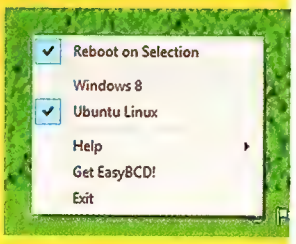
Recently, EasyBCD was updated with Windows 8 support, making it a snap to use the new Windows 8 boot menu to boot both Windows and Linux.

STEP 3: CHAIN-LOAD GRUB

Start EasyBCD and back up the current BCD configuration file by clicking 'BCD Backup/Repair > Backup Settings'. Next, click 'Add New Entry' and under the 'Linux/BSD' tab, click on the 'Type' field and choose 'GRUB2' (if using Ubuntu). Under the 'Name' field, change it to whatever distribution you're using and for 'Drive:', set it to 'Automatically locate and load'.



CHEATING WINDOWS 8's CHEAT



Once you have more than one operating system installed alongside Windows 8, you may notice some interesting behaviour with the way Windows 8 boots. When you're presented with the boot menu, this isn't a first step before choosing what operating system loads. As part of its changes to decrease boot times, Win 8 actually loads in the background and the boot menu is more a formality: if you click to boot Windows 8, you'll instantly be presented with the login screen; if you choose to load another operating system, your machine will reboot before loading into the other OS.

It's a bit of a hack on Microsoft's part to create the illusion of speed and while it doesn't bother us too much (having SSDs for boot drives helps), you can bypass this behaviour with a neat little tool also made by NeoSmart: iReboot.

EasyBCD has an option to install iReboot under 'Useful Utilities', but we found this didn't work. Instead, head to **neosmart.net/iReboot** to download and install the latest version.

Once installed, a tray icon will appear to you let choose from your boot menu what operating system you'll load at your next boot, making it possible to reboot *once* to Linux, instead of *twice* when rebooting from Windows 8. Neat!

Hit 'Add Entry' and you're done! If you click on the 'View Settings' button, you should see a new entry for your distribution or 'NeoSmart Linux' if you didn't change the name.

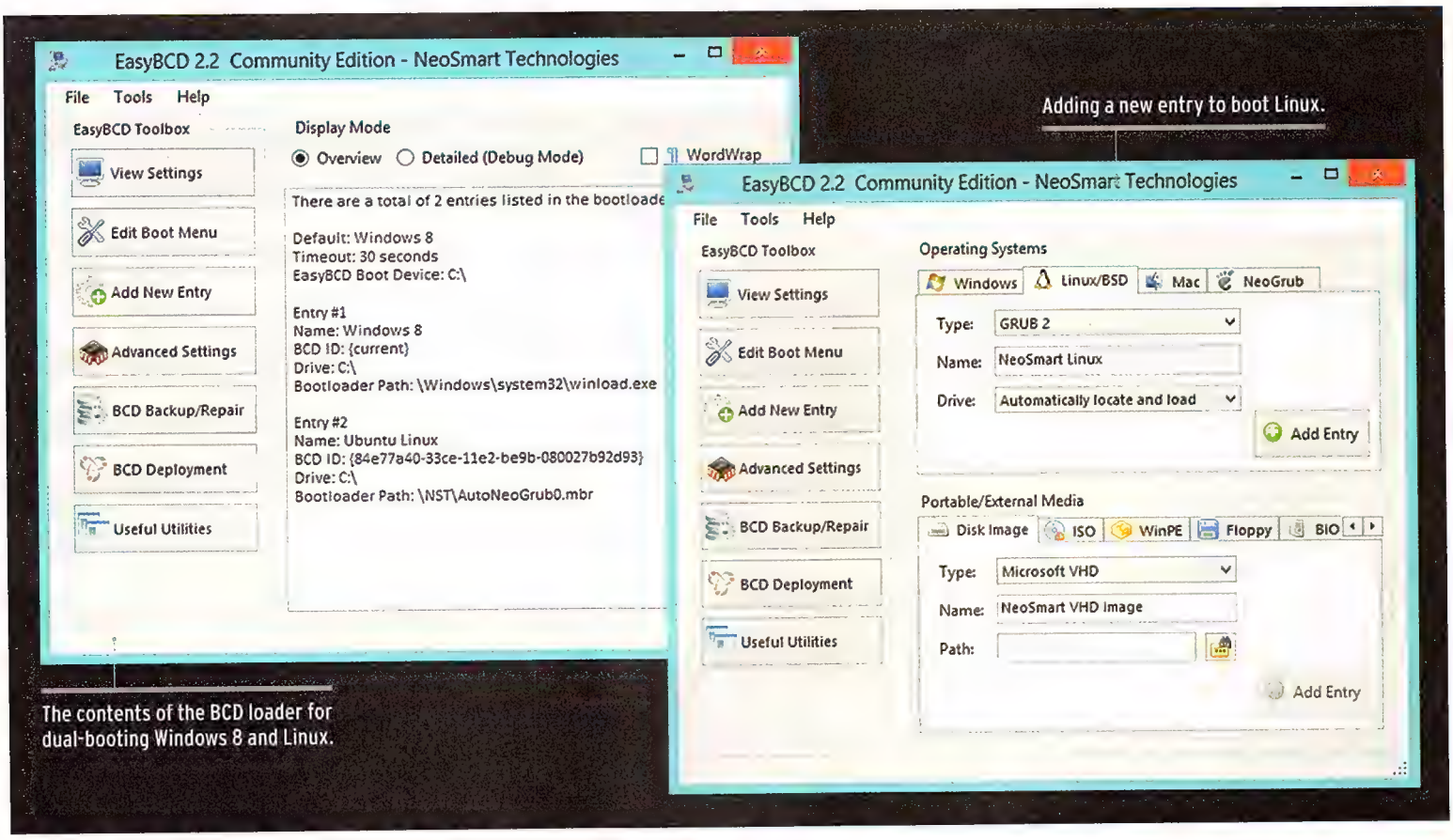
If you're using another version of Linux, check to make sure which version of GRUB it's using. If the original GRUB is being used, you'll need to select 'GRUB' instead and, since it can't be automatically located and loaded, set the partition you installed GRUB to in the 'Drive:' field. Later, if for whatever reason this isn't working, you can try ticking 'Use EasyBCD's copy of GRUB'.

Finally, if you forgot to change the name for the entry or want to change it later, click 'Advanced Settings' and under the 'Basic' tab rename the entry before clicking 'Save Settings'.

Naturally, you can also use EasyBCD to alter other boot menu settings such as reordering the list, setting the default operating system and changing the timeout. All of these can be found under the 'Edit Boot Menu' section. Don't forget if you run into any problems, you can also restore your original Windows 8 boot menu settings from the 'BCD Backup/Repair' option.

And that's it! Enjoy your dual-boot Windows 8 and Linux system with a more modern and cleaner boot time interface.

Windows 8 and Linux, sitting in a tree, K-I-S-S-I-N-G.



The contents of the BCD loader for dual-booting Windows 8 and Linux.

Do it with Dropbox

Jenneth Orantia explains how to ditch the iPad's closed file system and store all of your important documents in Dropbox.

YOU'LL NEED THIS

DROPBOX

The download is available from **www.dropbox.com**. You'll get 2GB with the free account.

Anyone that's ever tried to do 'real' work on an iPad will have quickly come up against its limitations. Getting files on and off it is a real pain, and while you can use the 'Open In' option to work on the same file in different apps, it's a clumsy workaround that makes it feel like you're playing leapfrog.

Dropbox offers a solution that's far more elegant. By outsourcing your file storage to Dropbox, you can get files on and off your iPad easily, have one set of files that your apps can access and be able to access those files from any other device that has Dropbox installed, including desktop PCs, an iPhone, and Android smartphones and tablets.

Of course, this only works for iPad apps that plug into the Dropbox file system, but there are dozens that do this. Using Dropbox, you could create a document in an office editing suite, then convert it to a PDF and send it on via email, all the while keeping the latest version of the file backed up to Dropbox so you can work on it from different devices, if that's what you want to do.

If you don't have a Dropbox account yet, head over to **www.dropbox.com**. The free account comes with 2GB of storage and you can boost this as high as 8GB by referring friends to the service and completing various setup 'games'. If you need more storage, you can upgrade to a paid account.

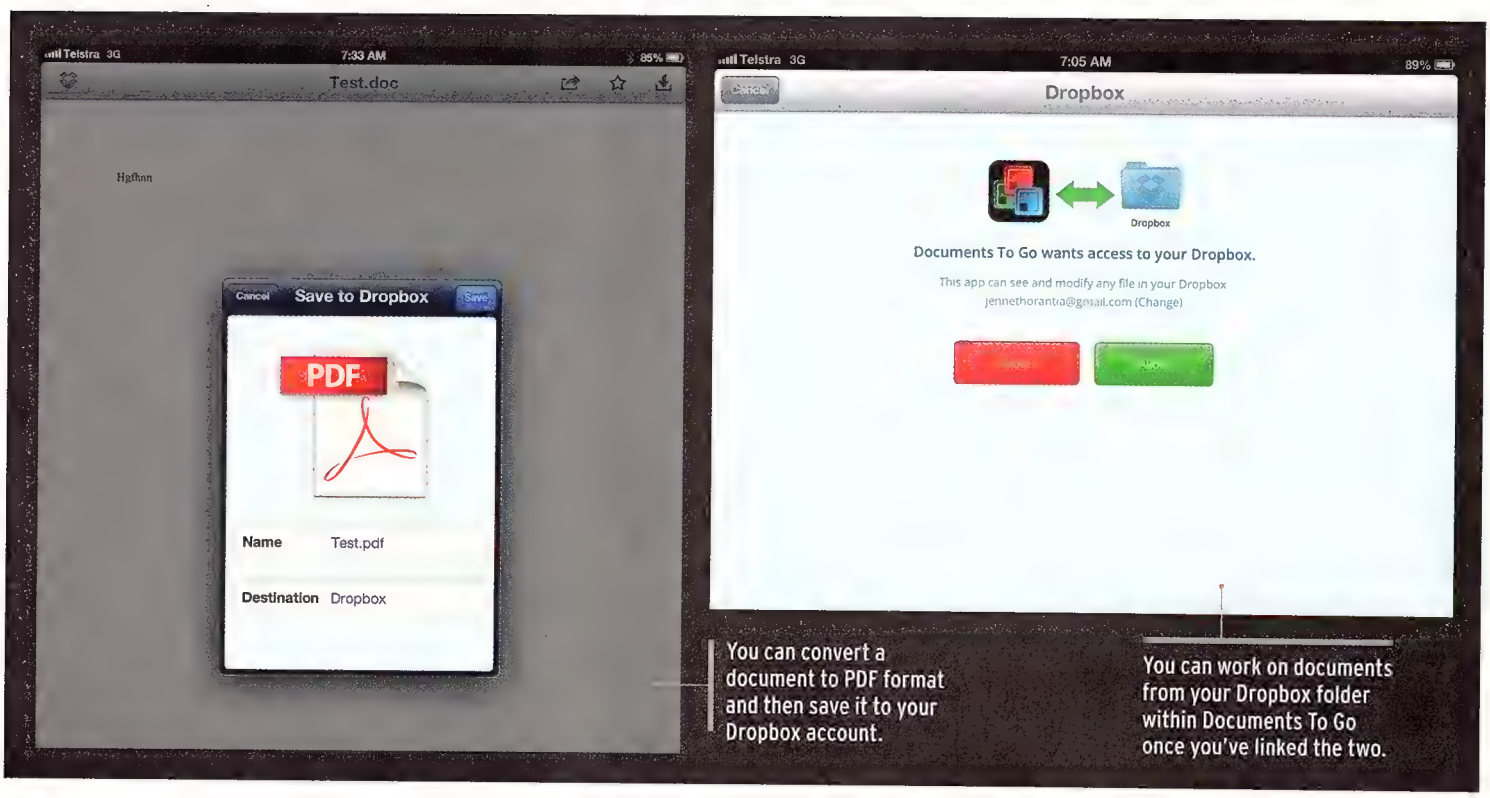
To make it easy to share files between your desktop computer and iPad, install the desktop Dropbox client. This will create a virtual Dropbox folder and any files or folders you put in it will automatically be uploaded and synchronised with your Dropbox account.

There are a few different office suites that support Dropbox, including Documents To Go and Office HD. We'll use Documents To Go for this example. To set it up with Dropbox, tap on the 'Online' tab at the bottom. Press the plus button and then select 'Dropbox'. Enter your username (typically, the email address you used for signing up to Dropbox) and tap the 'Log in' button. This will take you to the Dropbox sign-in page to enter your details.

There will now be a new entry in the 'Online Accounts' section for Dropbox. Selecting this folder will show you all the files and folders you have stored there. To add a new file to your Dropbox, press the plus button and select the type of file you'd like to create (we'll create a Word document for this example). Once you've finished the document, tap the left-most icon on the bottom toolbar and select 'Save'. Give it a name and it will be saved to your Dropbox as soon as you press the 'Back' button at the top of the screen.

You may want to convert this document to a PDF before sending it to other people. PDF Converter is an iPad app that works with Dropbox to convert Word, Excel, PowerPoint, iWork documents and web pages into PDFs. However, it doesn't open files directly from Dropbox like Documents To Go — you'll need to use the official Dropbox app to open the document in PDF Converter.

From the Dropbox app, open the document you just created in Documents To Go, then press the right-most icon in the top bar and select the 'Open In' option. Tap 'Open in PDF Converter' and the app will convert the document in PDF Converter. From there, you can send the PDF by pressing the right-most icon at the top and selecting the 'Send by Email' option. If you want to save the PDF in your Dropbox account, select the 'Open In' option and select 'Dropbox'.



Use Google Music outside of the US/UK

Google Music offers a handy way to access your music collection from the cloud... if you're in the right country. Simon Chester explains.

YOU'LL NEED THIS

TUNNELBEAR ACCOUNT

You'll need to register for a TunnelBear account to be able to bypass the region restrictions.

Google Music is a free cloud-based music platform that lets you store up to 20,000 songs online and listen to them from your PC or Android device. But it's not available in Australia.

Thankfully, circumventing the geographical restrictions put in place for streaming is actually a rather easy task, as the only region check occurs during the registration process. Purchasing music, however, is a whole other can of 'Dr. Worm' (They Might Be Giants), so it won't be covered here.

You sign up for the service via your desktop, so you'll first need to use a VPN/proxy to fool the registration page into believing that you're 'Born In The U.S.A.' (Bruce Springsteen). The one I recommend is TunnelBear, as it's both free (up to 500MB per month) and simple. Navigate to **www.tunnelbear.com** to download and install the client. During the installation process, you'll have to start an account with TunnelBear, as well as install a network connection.

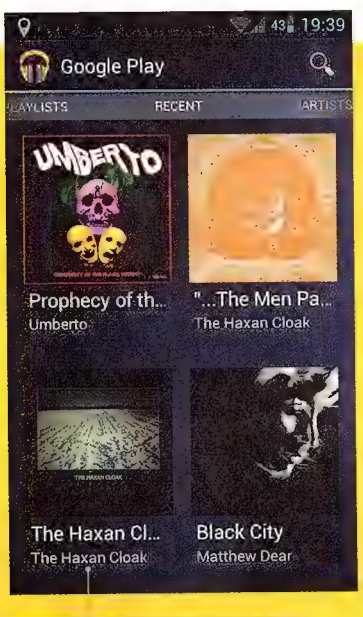
Then you just need to 'Push The Button' (The Chemical Brothers) to switch it to US, enable the VPN, scoot on over to **music.google.com**, click the 'Agree' button and download the Google Music desktop client.

You don't actually need to be connected via the US proxy while you upload all your music, so once you've started filling up a couple of those precious 20,000 music spaces (it's probably best to wait until one song uploads), feel free to disconnect TunnelBear.

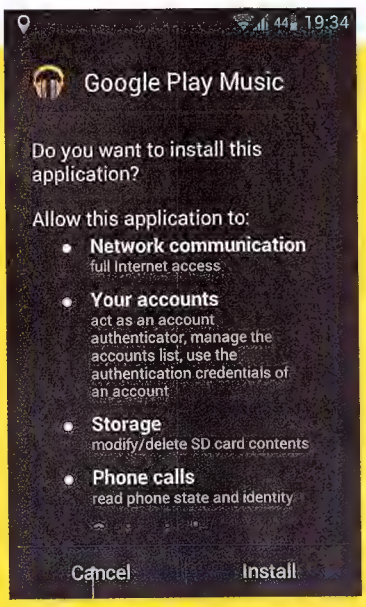
Note that while the Google Music app supports uploading .MP3, .AAC, .FLAC, .OGG and .WMA files, any .AAC, .FLAC and .OGG files will actually be transcoded to 320Kbps .MP3, while your .WMA files will only play on the Windows music client. I'm not a big fan of transcoding between lossy formats (although the 320Kbps format mitigates some of these problems), so I'd recommend uploading original source MP3s if you can. Of course, transcoding from FLAC won't be a problem as it's lossless, but you may prefer to transcode to a variable bit rate, to save on download costs when streaming to your handset.

If your phone doesn't already have the Google Music app on it – and 'Chances Are' (Bob Marley And The Wailers) that it doesn't – then you'll have to install it yourself. There are a few ways to do this: either by opting for a TunnelBear paid account, installing the TunnelBear Android app and then installing Google Music from the Play Store (go to 'Settings > Apps > Play Store' and press 'Clear Data' first, though); installing MarketEnabler from **me.rac.su/links** and visiting the Play Store as if you're in the US; or by searching Google or the XDA Forums for the latest Google Music APK (this is what I did, but you'll have to manually update it, as it won't appear in the Play Store).

Unfortunately, the Google Music app doesn't allow you to specify which folders to show music from, so all the sound recordings, ringtones and downloads you have on your phone will clutter up your library. Other than that, streaming those obscure tracks not otherwise available on streaming services is sure to give you 'Good Vibrations' (Beach Boys/Marky Mark and the Funky Bunch).



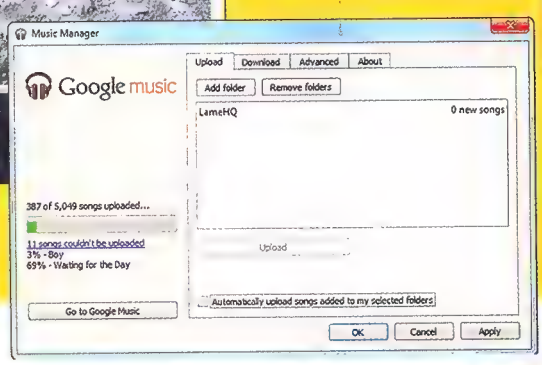
All the music, sound recordings, ringtones and downloads will appear.



You'll need to install the Google Music app if you don't have it already.

You can adjust and reorder the songs in the 'Now Playing' queue.

You can access your cloud-based music on your desktop, as well as any Android devices you may have.



Install the PlayStation Store on non-certified devices

The one-time King of Gaming has moved to Android, but only for certified devices. Simon Chester shows how to fix that.

YOU'LL NEED THIS

ANDROID DEVICE

This guide requires a rooted Ice Cream Sandwich Android device to work.

Sony and that other handheld console manufacturer have been losing relevance since the introduction of high-powered smartphones. The games are cheaper, there's no need to carry around media and indeed, no need to carry around an extra bit of hardware. It's been a fundamental shift in the way that we game on the go. Eager to keep their fingers in the gaming pie – especially after the lacklustre uptake of the latest-gen portable handhelds – Sony (the gaming company) has aligned with Sony (the mobile company) to introduce gaming to the Android ecosystem.

Sony released a PlayStation Mobile store for Android last year, but if you want in on the gaming action, you need to have a certified device. While the logic behind certifying devices is sound – after all, no-one wants a game that runs poorly or crashes – sometimes you just have to try something out for yourself. Most tablets that shipped with Honeycomb will likely have enough oomph to run these games, but the method outlined in this guide is geared towards rooted Ice Cream Sandwich devices, so apologies for that.

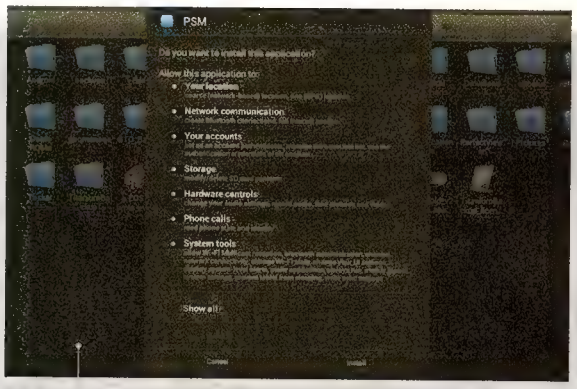
The first thing you need to do is install the PlayStation Store APK from **tinyurl.com/9rbcozw**. Once installed, open it. You'll probably get an error message, but if not, you've just saved yourself from having to read the next 300 words.

Download the flashable .ZIP file from the 'Download Zone' at **tinyurl.com/bbvafbk** (the site of the creator of this hack, whom I am indebted to) and extract it onto your PC. You then need to copy the contents of the 'Playcert' directory to your system directory. The easiest way to do this, I find, is through your favourite root-enabled file browser – I like ES File Explorer, but make sure to enable 'Root Explorer' in the options, as well as mount the system directory as writeable.

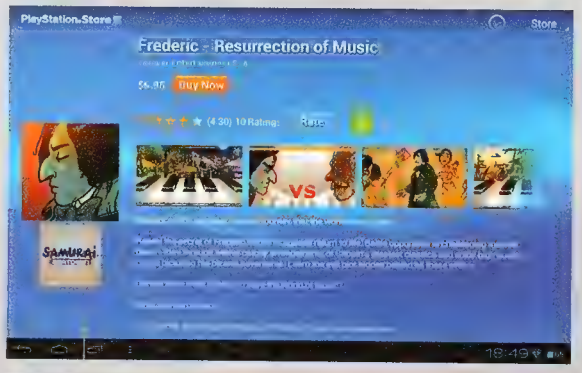
Copy the extracted files onto your tablet (any directory will do), then open up ES File Explorer (or its equivalent) and copy the 'Etc' and 'Framework' folders from the 'Playcert' directory over to your 'System' directory. If you're interested in the Bravia Post-Processing Engine or the xLoud Audio Processing Engine (I'm not), you'll need to copy the contents of the appropriate folders to your system directory, too. When that's done, go ahead and reboot your tablet.

Twiddle your thumbs while Android 'Optimises' itself (the twiddling is actually optional, but I find it quite therapeutic), and once your tablet is back up and running, open the PSM app, accept the terms and conditions, and sign in with your PSN account (or create a new one).

And that's it! You now have a working version of the PlayStation Market on your tablet, including all those hot titles like *Frederic – Resurrection of Music* and *Pinky Spots Leg Massage* (seriously, what?). There are both free and paid games available, and purchases use the credit tied to your PSN account. Of course, not every game is guaranteed to work (your device isn't certified, after all), but there's no real harm in trying. APC



The PlayStation Store for Android is (usually) only available to certified devices.



At last, you'll be able to play *Frederic – Resurrection of Music* on Android.

You can browse through the games via category.

Burn in your CPU with Linux

Make sure your rig will survive the rigours of your demands on it with a stress test.

YOU'LL NEED THIS

ANY OLD DISTRO

You'll need access to a Linux distribution, either installed or running off a Live CD (try Ubuntu), as well as the confidence to type a few commands into the terminal.

STRESSLINUX

We do further testing with the ISO version of StressLinux (**www.stresslinux.org**).

If there's one thing Linux is good at, it's stretching hardware to its limits. Whether that's a diminutive ARM CPU sprinting like a caffeinated hamster within a Raspberry Pi, or the behemoth-sized computing grid that spreads its fronds across Europe as it crunches through the petabytes of data produced by the Large Hadron Collider, Linux works very hard.

This is because the kernel, the chunk of code at the heart of the operating system, has been optimised to make best use of any and all resources available to it, whether that's a tiny CPU or a network of many thousands. Unused memory isn't left waiting, spare CPU and GPU cycles are assimilated, and storage space parallelised, forked and RAIDed.

All of this means Linux is a particularly good option if you want to push your hardware to its limits. If your CPU can survive a few days under constant load from the Linux kernel, you can be fairly certain it won't fail halfway through a weekend's gaming session. Similarly, if you want to run a Linux machine as a server and hide it in the loft, you can be sure it won't fail before you put the ladder away.

Burning-in your hardware used to be a good way to optimise CPU performance, the theory being that stressing the silicon at an early stage would enable you to squeeze out lower voltages and higher clock speeds. This may not be as true with modern processors, as most are effectively 'burned-in' at the class testing stage of manufacturing, but that doesn't mean burn-in isn't still useful. It is because it enables you to discover the weakest links in your configuration, ensuring the chain of reliability that starts with your PSU and ends with your GPU operating under heavy load is up to whatever task you throw at it, giving you confidence in your cooling provision and system performance. Whether you overclock your system or not, this confidence is essential.

SIMPLE SOLUTIONS

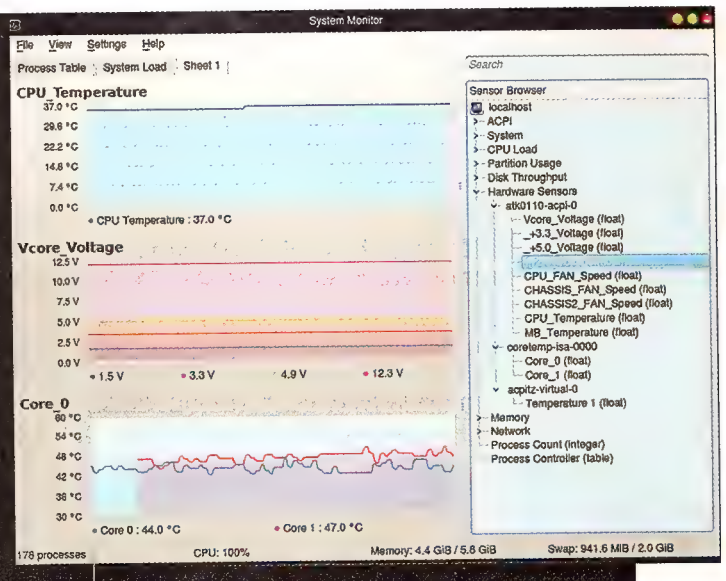
As you might expect from an OS that flourishes because of user choice, there are many different ways of putting your system under serious load. It shouldn't matter which distribution you're using or the age of that distro, the package manager will be full of utilities that will stress your CPU. If you don't have Linux installed, you could easily use one of the many Live CDs/DVDs available, which will boot to a working Linux environment with no effort other than placing the disc in the drive and making sure your system boots from it. We'd recommend the latest Ubuntu if you've not used Linux recently, as it's compatible with the widest amount of hardware while remaining easy to use. You can even run some simple tests from most boot menus, as many distributions include `memtest`, which will grind its way through your memory looking for problems. When you do get to the Linux desktop, you don't need to install anything if you don't want

MONITORING TEMPERATURES

All the burn-in tools we've covered are great for stressing out your system, but they provide very little feedback. This is because most people will monitor the state of their systems using different methods. The best way on Linux is to install a package called `lm-sensors`.

This will then give you access to a script called `sensors-detect`, which you'll need to run from the command line with system administrator privileges – type `sudo sensors-detect` from the Ubuntu terminal, for example. You'll then be asked a series of questions – these are the same questions asked by the StressLinux distribution, because it's configuring the sensors package for you. You can mostly leave the questions at their default values and `sensors-detect` will go off and attempt to discover the various sensors within your system. The final question will ask if the tool can create a config file. Say 'Yes' and everything should be configured.

Then, when you type `sensors` as an ordinary user, you'll see a table containing the various readings for your hardware, and you'll be able to monitor the effect your stress testing is having on your system.



There are many graphical front-ends to `sensors`. Just search through your distro's package manager and try a few. This one is KDE's KSysGuard.

DOMAIN NAMES

If you want to do something useful with your system, rather than aimlessly number crunch, you could just embark on a big job, such as compiling the just-released kernel, rendering *Elephants Dream* in 3D, or helping in the Folding@Home project. These tasks would put your system under stress while doing something far more productive with all that crunch work.

to. For a very quick and easy fix, you could, for example, open the command line terminal and type: `while :; do :; done &`.

This is a very simple Bash script (Bash is the flavour of command line most Linux distros enable by default). It creates an infinite loop that should keep your CPU occupied at 100%. For other cores and CPUs, you'll need to manually run other instances of the same command. You can do this by opening other terminals or adding a new tab to the current terminal. But there are several shortfalls in this approach. Despite the 100% CPU usage, it's not using the various parts of your CPU equally. There's a good chance the FPU isn't being touched, for example, which might affect the overall efficiency of your CPU cooler. For this reason, it's worth using a tool designed specifically to put your CPU under load. From the command line, this is easily done by installing another command `stress`. But before you move on, press Ctrl+C in the terminal sessions to force exit the infinite loops we created.

STRESS BY NAME

`stress` isn't a comprehensive solution, but it is going to be powerful enough for most circumstances. Also, because it's designed specifically to put load on your system, it does a better job of using the entire instruction set of your CPU than Bash commands, as well as other components (such as memory and storage) if you let it. Once installed, typing `stress` on the command line will output a simple set of arguments for its use. Adding `--cpu 2`, for example, will spawn two tasks constantly working out the square root of a number. You can add memory allocation/deallocation with `--vm 1` argument, followed with `--vm-bytes 128M` for the amount of memory you want to process to play with. Finally, if you want to add some file system input/output to the mix, add the `--io 1` argument. This will force the file system to constantly flush its buffers. Putting this together, you should use this command: `stress --cpu 2 --vm 1 --vm-bytes 128M --io 1 &`.

After running this command, you should find that your system is operating under considerable load, hopefully to the point where it may become slightly unresponsive, although not too much – the Linux scheduler is excellent at maintaining interactive sessions while experiencing periods of heavy load.

If you want to understand a little more about what the `stress` command is doing, add the `--verbose` argument. This will provide some background information on what the tool is actually doing to your system, as well as report on how the processes are running. However, if you want to see more about how your system is coping with the load, you'll need to look at a couple of system utilities.

MONITORING YOUR CPU

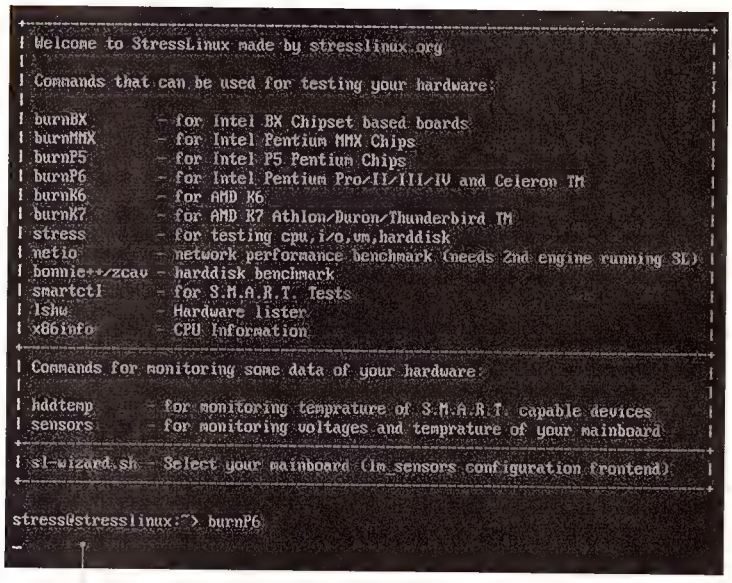
The perennial command for monitoring a Linux system is called `top`. There isn't a Linux distribution, or even a Unix installation, that won't display a dynamic process list, along with the distinctively cryptic usage table, when you type this command. The process list is sorted by usage, with the most CPU-hogging tasks at the top.

If you're still running the previous `stress` command, you should see four separate `stress` processes. These equate to two for the CPU tasks: one for the memory allocation process and one for the file system input/output. Anything else that's fighting for contention should be bubbling up and down among these tasks. The top table displays the uptime for your machine, how many users are logged in and the trinity of the load average, which makes no sense if you've not encountered it before, but they are important for monitoring your system over time. This is what it looks like for us: `load average: 1.14, 0.78, 0.20`.

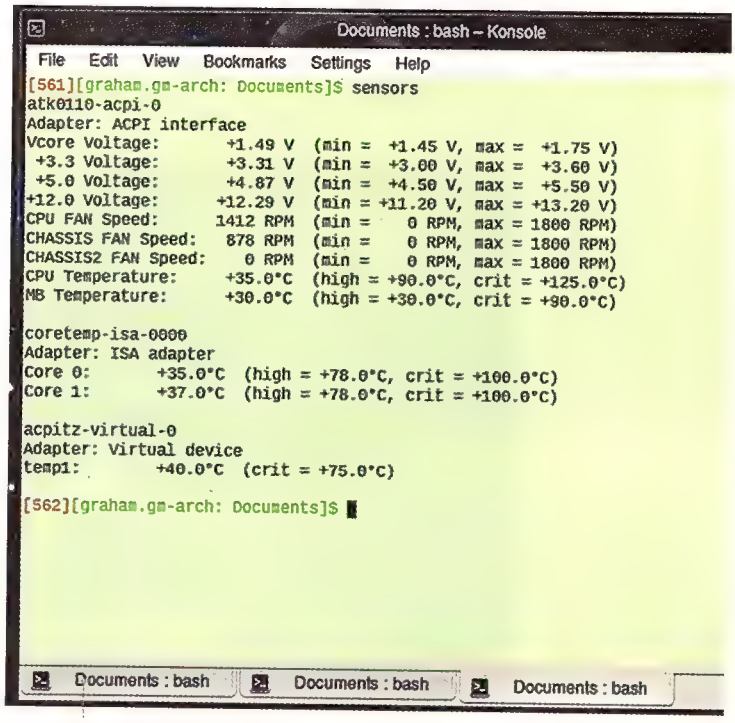
Those three numbers represent the load average over progressively longer periods of time: 1, 5 and 15 minutes, from left to right, and the

PREPARE TO FAIL

Running many of the commands we've covered on remote servers will help you anticipate how your machines will hold up under a period of heavy load. But if the worst should happen, make sure you or someone else is physically able to restart the machine.


Welcome to StressLinux made by stresslinux.org
Commands that can be used for testing your hardware:
burnBX - for Intel BX Chipset based boards
burnMMX - for Intel Pentium MMX Chips
burnP5 - for Intel P5 Pentium Chips
burnP6 - for Intel Pentium Pro/II/III/IV and Celeron TM
burnK6 - for AMD K6
burnK7 - for AMD K7 Athlon/Duron/Thunderbird TM
stress - for testing cpu,i/o,vm,harddisk
netio - network performance benchmark (needs 2nd engine running SL)
bonnie++/zcav - harddisk benchmark
smartctl - for S.M.A.R.T. Tests
lshw - Hardware lister
x86info - CPU information
Commands for monitoring some data of your hardware:
hddtemp - for monitoring temprature of S.M.A.R.T. capable devices
sensors - for monitoring voltages and temprature of your mainboard
sl-wizard.sh - Select your mainboard (lm_sensors configuration frontend)
stress@stresslinux:~> burnP6

StressLinux includes tools for stressing your CPU, memory, network and storage.


Documents : bash – Konsole
File Edit View Bookmarks Settings Help
[561][graham.gm-arch: Documents]$ sensors
atk0110-acpi-0
Adapter: ACPI interface
Vcore Voltage: +1.49 V (min = +1.45 V, max = +1.75 V)
+3.3 Voltage: +3.31 V (min = +3.00 V, max = +3.60 V)
+5.0 Voltage: +4.87 V (min = +4.50 V, max = +5.50 V)
+12.0 Voltage: +12.29 V (min = +11.20 V, max = +13.20 V)
CPU FAN Speed: 1412 RPM (min = 0 RPM, max = 1800 RPM)
CHASSIS FAN Speed: 878 RPM (min = 0 RPM, max = 1800 RPM)
CHASSIS2 FAN Speed: 0 RPM (min = 0 RPM, max = 1800 RPM)
CPU Temperature: +35.0°C (high = +90.0°C, crit = +125.0°C)
MB Temperature: +30.0°C (high = +30.0°C, crit = +90.0°C)
coretemp-isa-0000
Adapter: ISA adapter
Core 0: +35.0°C (high = +78.0°C, crit = +100.0°C)
Core 1: +37.0°C (high = +78.0°C, crit = +100.0°C)
acpitz-virtual-0
Adapter: Virtual device
temp1: +40.0°C (crit = +75.0°C)
[562][graham.gm-arch: Documents]$
Documents : bash
Documents : bash
Documents : bash

The `sensors` package monitors the state of your system while running a burn-in tool.

number represents the demand being placed on your CPU. Note that 1.0 is equivalent to 100% of a single CPU (2.0 would be the equivalent of 100% across two CPUs, if this is your system configuration) and that's with no other processes waiting to use the CPU, whereas 0.5 is 50% of a single CPU.

In our system, over the previous minute, the CPU capacity was overloaded such that 0.14, or 14%, of processes, were waiting to run. The previous measurements show the state of the system as we stopped and ran stress, taking the CPU to roughly 80% and 20%. This is why server admins look horrified if they've got a number over 0.8 for either the 5- or 15-minute entries, because it means (unless you're being Slashdotted) there's some wayward process running wild on the system. If you want a prettier alternative to **top** without going all graphical, many distributions include **htop** which presents the same information, only in a slightly more eye-friendly format.

STRESSLINUX

As effective as these solutions are, they're not designed for burn-in testing, and while you could easily litter your Linux installation with further package installations, this is one of those times where a specific Linux distro makes sense. Using a Live CD instead of an installation, for instance, safeguards your personal data should testing result in a system restart or total failure.

There are several distributions that can do just this, but our favourite is the aptly named StressLinux. Unlike Ubuntu, it's a no-frills distro that simply packages the tools you need to test your hardware and nothing else. The advantage of this is that it's a small distro, with the 64-bit ISO download taking around 220MB, and there are images for both USB sticks and a VMware appliance if you need alternatives.

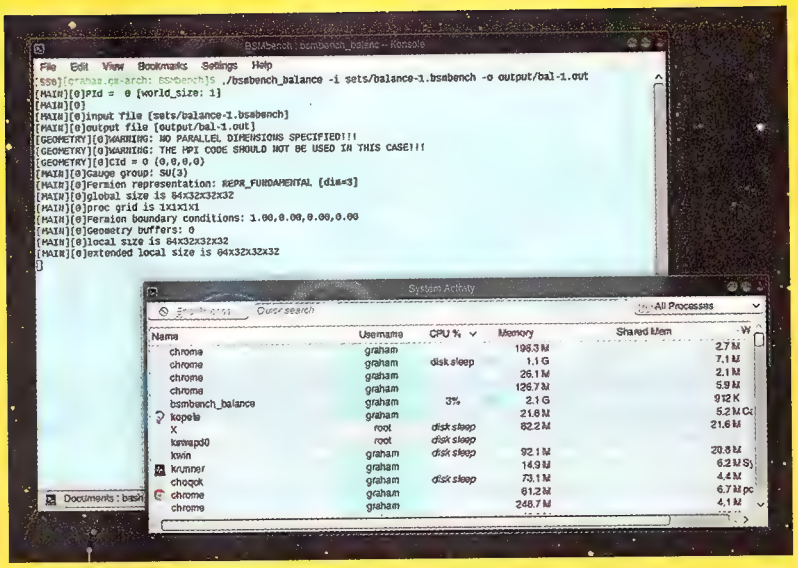
On first boot, choose the default option from the 'Start' menu and a few moments later, you'll see the login prompt. The default login and password is **stress** for both, after which you'll be asked to choose a keyboard layout followed by a script called **sensors-detect** . See the box 'Monitoring temperatures' on page 99 for further details, otherwise skip this step by selecting 'No' for every option. You'll then be dropped back to the command line, where you'll see a useful list of included utilities.

BURN UTILITIES

In the list of utilities, you'll see **stress** as well as other tools that will put your storage and networking through the ring of fire. The ones we're interested in are the **burn** commands. These are designed to heat up your CPU using handcrafted assembler code to target every area of your silicon.

The platforms supported, as described by their names, are dated, but choosing between **burnK7** and **burnP6** , for AMD and Intel platforms, respectively, will still yield good results on modern hardware. You will also need to run an instance of each command for each CPU core. But unless you've got some Linux experience, it won't be obvious how to do this from a single command prompt. The answer is to either switch to a different login prompt with Ctrl+Alt and a function key, or run the command as follows: **nohup burnP6 &** . This will run the **burn** command in the background and allow you to continue typing into the terminal. You can enclose as many commands within **nohup** and **&** to run as many processes as you wish.

It's then a case of making sure your fire alarm is working and leaving your system running for a day or two. If your PC survives, it's in awesome shape. If not, you'll need to look into buying extra cooling or power provision.


BSMBench : bsmbench_balance – Konsole
File Edit View Bookmarks Settings Help
[556][graham@x-arch: BSMBench]$ ./bsmbench_balance -i sets/balance-1.bsmbench -o output/bal-1.out
[MAIN][0]Pid = 0 [world_size: 1]
[MAIN][0]
[MAIN][0]input file [sets/balance-1.bsmbench]
[MAIN][0]output file [output/bal-1.out]
[GEOMETRY][0]WARNING: NO PARALLEL DIMENSIONS SPECIFIED!!!
[GEOMETRY][0]WARNING: THE MPI CODE SHOULD NOT BE USED IN THIS CASE!!!
[GEOMETRY][0]Cid = 0 (0,0,0,0)
[MAIN][0]Gauge group: SU(3)
[MAIN][0]Fermion representation: REPR_FUNDAMENTAL [dim=3]
[MAIN][0]Global size is 64x32x32x32
[MAIN][0]proc grid is 1x1x1x1
[MAIN][0]Fermion boundary conditions: 1.00,0.00,0.00,0.00
[MAIN][0]Geometry buffers: 0
[MAIN][0]local size is 64x32x32x32
[MAIN][0]extended local size is 64x32x32x32
System Activity
All Processes
Name Username CPU % Memory Shared Mem
chrome graham 198.3 M 2.7 M
chrome graham disk sleep 1.1 G 7.1 M
chrome graham 26.1 M 2.1 M
chrome graham 126.7 M 5.9 M
bsmbench_balance graham 3% 2.1 G 912 K
kopete graham 21.8 M 5.2 M
X root disk sleep 82.2 M 21.6 M
kswapd0 root disk sleep
kwin graham disk sleep 92.1 M 20.8 M
krunner graham 14.9 M 6.2 M
chocqok graham disk sleep 73.1 M 4.4 M
chrome graham 61.2 M 6.7 M
chrome graham 248.7 M 4.1 M
Documents : bash

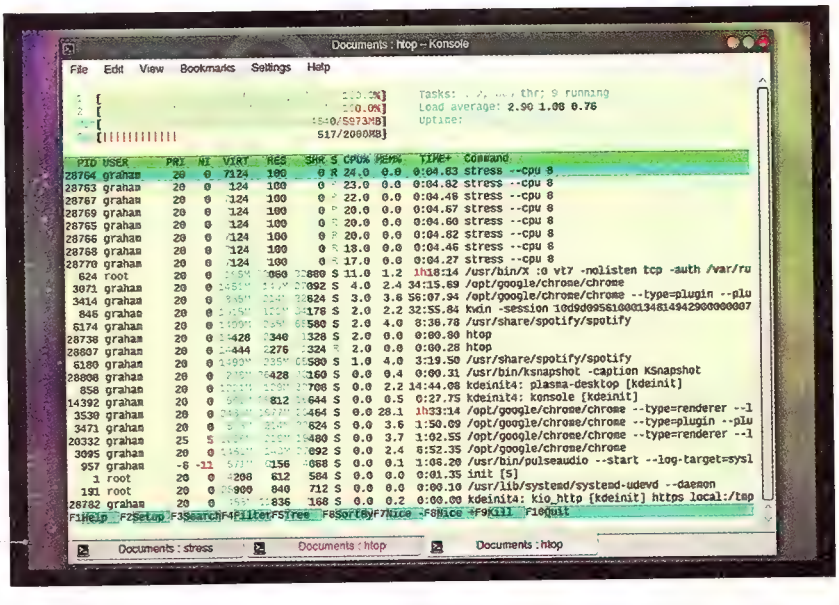
We've found that the benchmark tool, BSMBench, put our test systems under the most amount of stress.

LINUX BENCHMARKS

A field closely related to burn-in tools is benchmarking. It might not have the same aim, but it creates the same results: putting your hardware through hell. The main difference is that benchmarks need to be timed for the results to make any sense, so you wouldn't keep them running for days on end. However, you'll be able to see whether the tweaks you make to your system are worthwhile and whether your system can survive a combined onslaught.

The famous Heaven benchmark, while designed primarily to test your GPU prowess, will still put your CPU under heavy load. Testing the cooling on your CPU, motherboard, GPU and case is a legitimate exercise.

There are several Linux-specific benchmarks, although our favourite is an open-source project called BSMBench (**bsmbench.org**). This was developed to calculate the processing power within grids of computers, but it works equally well in the world of multicore Hyper-Threading and can give some very surprising results while still putting your CPUs under strain. It's too new to be included with any distribution, but it can be built easily enough by following the README instructions that are part of the direct download. You just need to run a simple script and execute a comprehensive benchmark of a single core – just type: **./bsmbench_balance -i sets/balance-1.bsmbench -o output/bal-1.out** .


Documents : htop – Konsole
File Edit View Bookmarks Settings Help
Tasks: . , ... thr; 9 running
Load average: 2.90 1.08 0.76
Uptime:
PID USER PRI NI VIRT RES SHR S CPU% MEM% TIME+ Command
28764 graham 20 0 7124 100 0 R 24.0 0.0 0:04.63 stress --cpu 8
28763 graham 20 0 124 100 0 R 23.0 0.0 0:04.62 stress --cpu 8
28767 graham 20 0 124 100 0 R 22.0 0.0 0:04.46 stress --cpu 8
28769 graham 20 0 124 100 0 R 20.0 0.0 0:04.67 stress --cpu 8
28765 graham 20 0 124 100 0 R 20.0 0.0 0:04.60 stress --cpu 8
28766 graham 20 0 124 100 0 R 20.0 0.0 0:04.82 stress --cpu 8
28768 graham 20 0 124 100 0 R 18.0 0.0 0:04.46 stress --cpu 8
28770 graham 20 0 124 100 0 R 17.0 0.0 0:04.27 stress --cpu 8
624 root 20 0 1h18:14 /usr/bin/X :0 vt7 -nolisten tcp -auth /var/ru
3071 graham 20 0 4.0 2.4 34:15.69 /opt/google/chrome/chrome
3414 graham 20 0 3.0 3.6 56:07.94 /opt/google/chrome/chrome --type=plugin --plu
846 graham 20 0 2.0 2.2 32:55.84 kwin -session 10d9d095610001348149429000000007
6174 graham 20 0 2.0 4.0 8:36.78 /usr/share/spotify/spotify
28738 graham 20 0 2.0 0.0 0:00.00 htop
28807 graham 20 0 2.0 0.0 0:00.28 htop
6180 graham 20 0 1.0 4.0 3:19.50 /usr/share/spotify/spotify
28808 graham 20 0 0.0 0.4 0:00.31 /usr/bin/ksnapshot -caption KSnapshot
858 graham 20 0 0.0 2.2 14:44.08 kdeinit4: plasma-desktop [kdeinit]
14392 graham 20 0 0.0 0.5 0:27.75 kdeinit4: konsole [kdeinit]
3530 graham 20 0 0.0 28.1 1h33:14 /opt/google/chrome/chrome --type=renderer --l
3471 graham 20 0 0.0 3.6 1:50.09 /opt/google/chrome/chrome --type=plugin --plu
20332 graham 25 5 0.0 3.7 1:02.55 /opt/google/chrome/chrome --type=renderer --l
3095 graham 20 0 0.0 2.4 5:52.35 /opt/google/chrome/chrome
957 graham -6 -11 0.0 0.1 1:06.20 /usr/bin/pulseaudio --start --log-target=sysl
1 root 20 0 0.0 0.0 0:01.35 init [5]
191 root 20 0 0.0 0.0 0:00.10 /usr/lib/systemd/systemd-udevd --daemon
28782 graham 20 0 0.0 0.2 0:00.00 kdeinit4: kio_http [kdeinit] https local:/tmp
F1Help F2Setup F3SearchF4FilterF5Tree F6SortByF7Nice -F8Nice +F9Kill F10Quit
Documents : stress
Documents : htop
Documents : htop

Use **htop** to get a slightly prettier representation of your data.

Safeguard your PC with Malwarebytes

Jon Thompson shows you how to get a second opinion on your computer's defences.

YOU'LL NEED THIS

MALWAREBYTES

You can download the free version from **www.malwarebytes.org**.

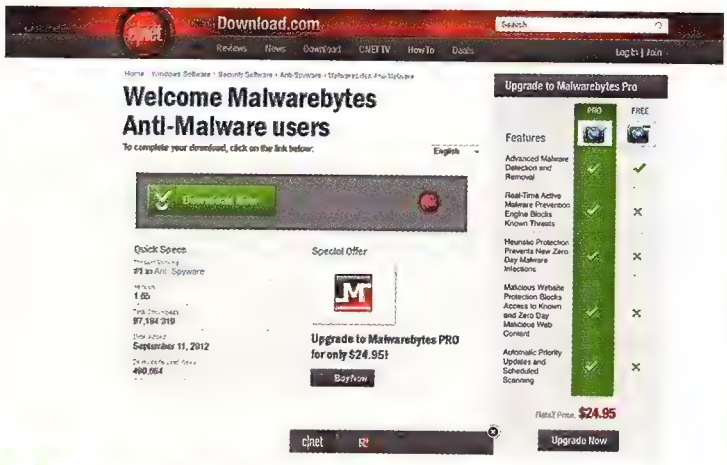
You may be paying for top-of-the-range antivirus software, but there's still a chance that it might miss something. That's because antivirus vendors don't share information about new threats with one another, preferring to guard the secrets of their success from potential rivals. So what one product might pick up as a threat, another might miss or think is benign.

Because of this, when faced with a potential infection, network security professionals refuse to believe the results of any single antivirus product. For a second opinion, they use scanners designed to fit their needs and so can you. Malwarebytes is a tool that's used in the security industry to provide such a second opinion.

I'm going to show you how to use it to establish if there's any cause for concern on your computer, and to then perform a deep scan to root out any lurking malware that your normal product might have missed.

DEEP SCAN YOUR PC

Find and repair holes in your system's security.

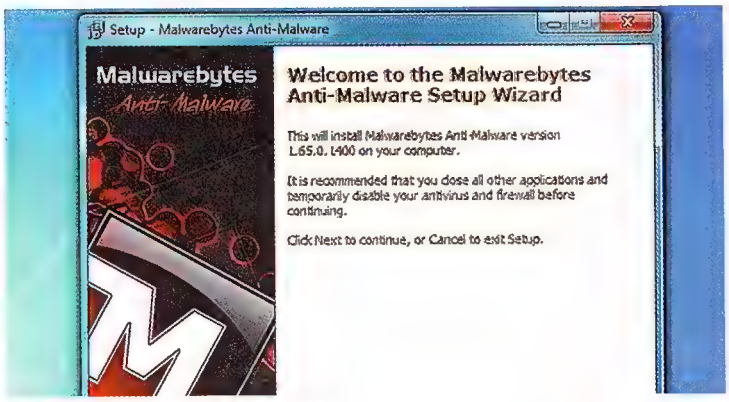


01 DOWNLOAD THE TOOL

First, install the free version of Malwarebytes by visiting **www.malwarebytes.org** and clicking on the 'Free download' link on the home page. Doing so will take you to the CNET download site, which is a repository used by many thousands of companies to host their official executable for users to download. Click the green 'Download now' button and save the file to your PC.

02 RUN THE EXECUTABLE

Unless you've opted to store it elsewhere, the Malwarebytes executable will have been saved to your 'Downloads' folder. Double-click the file (called 'Mbytes-setup' followed by a version number) to begin installation. 'User Account Control' will appear in a pop-up window to ask if you want to continue. Click 'Yes' and accept English as the installation language.


Setup - Malwarebytes Anti-Malware
Malwarebytes
Anti-Malware
Welcome to the Malwarebytes Anti-Malware Setup Wizard
This will install Malwarebytes Anti-Malware version 1.65.0.1400 on your computer.
It is recommended that you close all other applications and temporarily disable your antivirus and firewall before continuing.
Click Next to continue, or Cancel to exit Setup.

03 GET IT INSTALLED

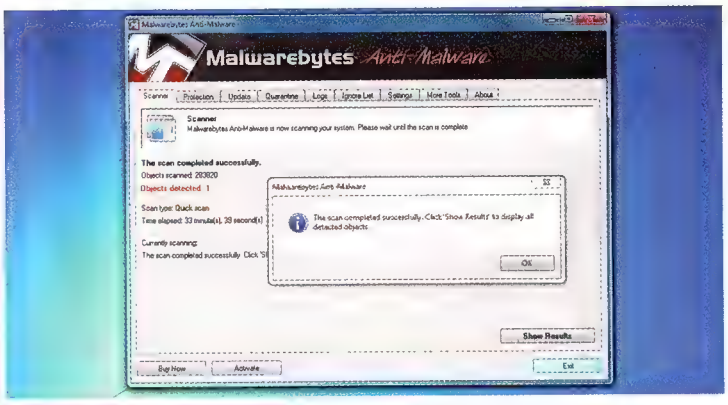
The Malwarebytes installation wizard will now appear. Accept the default options by clicking 'Next' until you get to the 'Install' button and check the box to accept the licence agreement. If you don't want to create a desktop icon, or want to change the installation directory, you can do so in this wizard by changing the relevant options. Finally, click 'Install' to continue.

04 UPDATE DEFINITIONS

Once Malwarebytes is installed, leave the options to run and update the software selected. Ensure that your broadband connection is up and running and then click 'Finish'. A progress window will appear as the Malwarebytes antivirus definitions are downloaded and installed, along with any updates to the program itself. Once the process is complete, click 'OK' to continue.

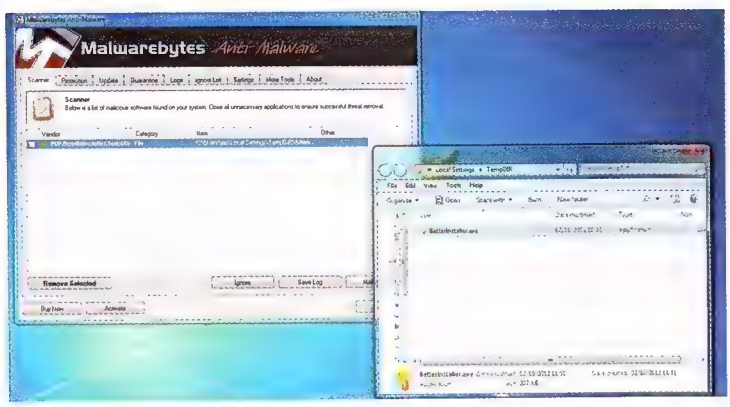
05 RUN A QUICK SCAN

Performing a quick scan can warn you about any potential problems before you delve deeper. If this option isn't already visible, click the 'Scanner' tab on the user interface. Ensure that 'Quick scan' is selected and click the 'Scan' button. Malwarebytes will then begin checking user files looking for malware signatures. It can take half an hour or more to complete this step.



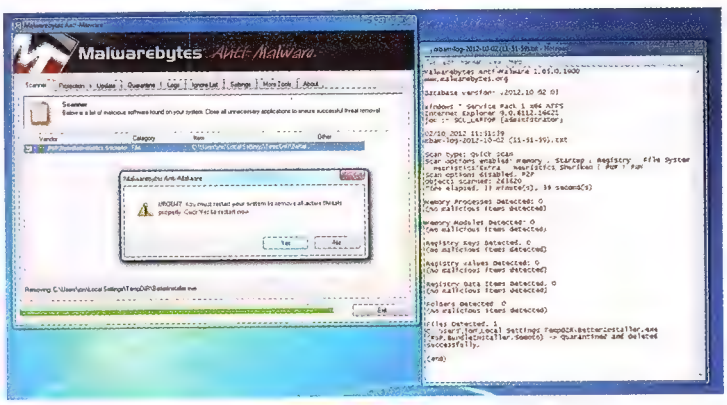
06 CHECK THE SUMMARY

When the quick scan is complete, you may notice that Malwarebytes has picked up one or more threats, which it has highlighted in red. Don't panic, the program will flag many different objects as suspicious, including benign cookies and installers used by legitimate sites and programs. To see details of the objects it has found, click the 'Show results' button.



07 EXAMINE IN DEPTH

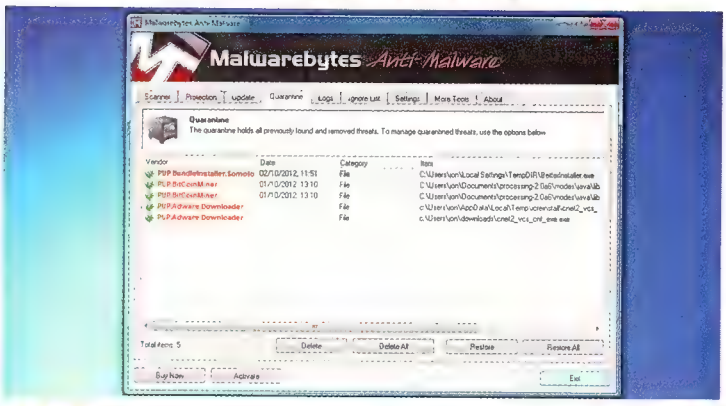
The detailed results screen provides more information about the suspicious objects the program has uncovered. Many of these will be PUPS (Potentially Unwanted Programs), and the list can also include legitimate installers and cookies. If you right-click on an item you can select 'Jump to location'. This option opens an Explorer window in the folder containing the suspicious item.



08 REMOVE THREATS

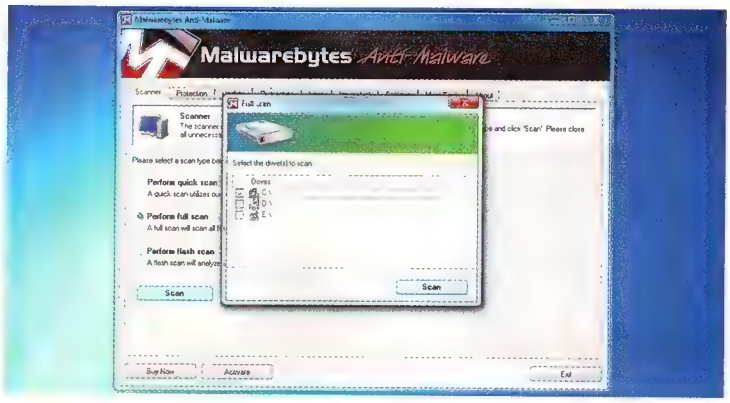
Right-click on the results pane and choose 'Check all items'. This selects all the discovered threats in one go. To delete them all, simply click 'Remove selected'. If there are items you know are OK, deselect them by unticking their tick boxes before clicking 'Remove selected', otherwise they'll be erased along with the rest. Malwarebytes will display the result of its actions in a Notepad file.

DEEP SCAN YOUR PC (CONTINUED)



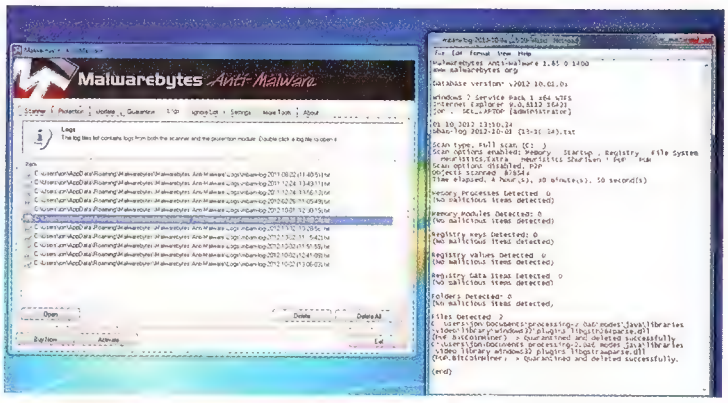
09 EXAMINE & QUARANTINE

All the files and other nasties you removed in the previous step will be sent to a quarantine area. You can safely leave them here, or delete them by selecting the 'Delete all' button. By allowing the quarantine area to fill up rather than deleting potential threats immediately, you can build up a picture of the threats to which your regular activities expose you to risks online.



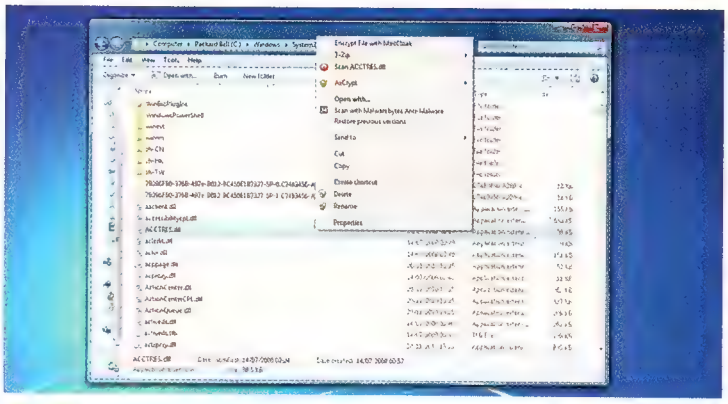
10 PERFORM A FULL SCAN

It's a good idea to schedule the backup to run automatically so the most recent versions of your files are saved. This will protect your data in case a piece of malware manages to get through your defences. From the 'Backup and Restore' window, click 'Change settings' and set a time that's right for you. Ideally, this should be when your PC is switched on, but not being used.



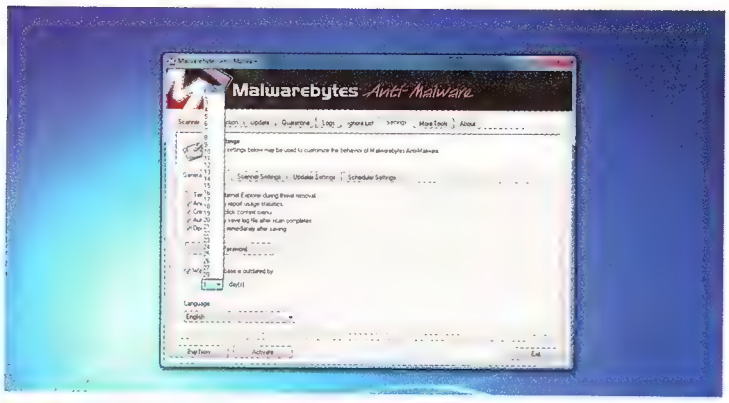
11 REVIEW THE LOGS

The activities you've performed so far will have generated a few log files, which you can find under the 'Logs' tab. Double-clicking an entry opens it in Notepad. Each of these log files contains data about the version of Malwarebytes, along with details of your machine, the time and date of the scan, the options you selected and a detailed list of the suspicious files detected.



12 CHECK INDIVIDUAL FILES

Malwarebytes adds a menu to Windows Explorer that lets you scan individual files. This will enable you to check downloaded executables before running them. To use this feature, close Malwarebytes and open Windows Explorer. Right-click the file you want to check and select 'Scan with Malwarebytes'. The user interface will open and proceed as if you were performing a quick scan.



13 SET UPDATE OPTIONS

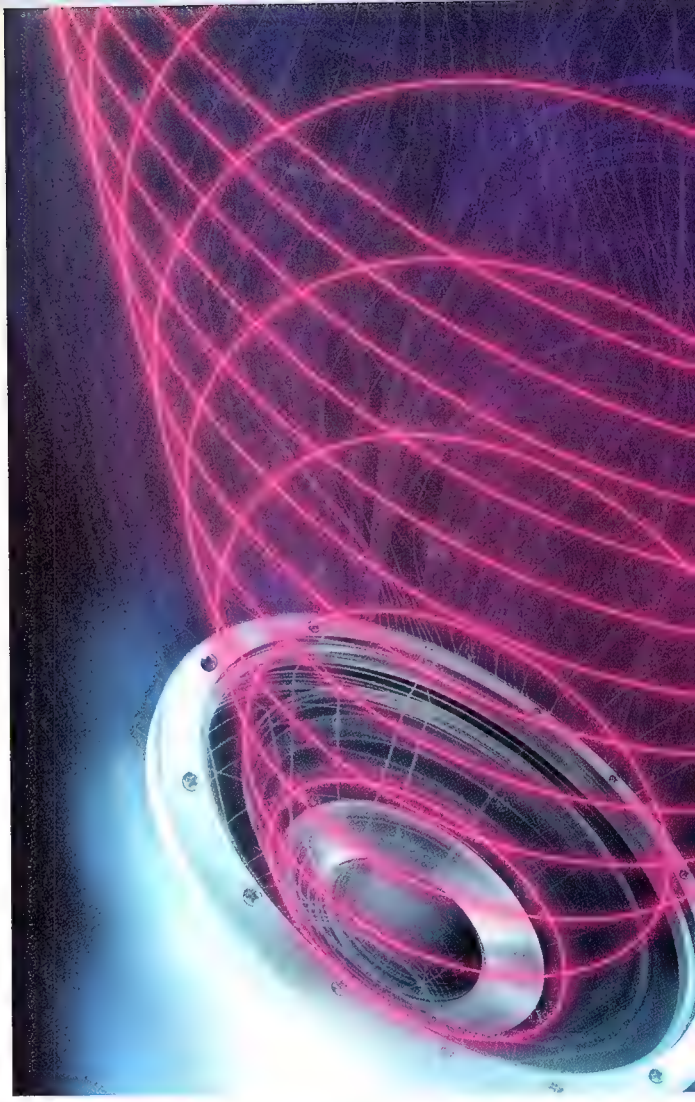
When Malwarebytes installs, it updates its database with the latest malware definitions. By default, it only notifies you when the database is seven days out of date. This is a long time in PC security. If you want the software to remind you to update the database before scanning, click 'Settings' and set 'Days' to '1'. When you see the update warning, select the 'Update' tab and click 'Check for updates'.

14 KEEP IT HANDY

Malwarebytes is handy to have around and is used all over the world by computer security professionals who want a second opinion on PC security. It can also give the rest of us peace of mind that our defences are doing their job online. While the paid version adds more benefits (like real-time protection), the free edition still reveals hidden security problems and fixes them quickly.

Create retro sound effects

Want to create the nostalgic sounds of old video games? Henry Winchester explains how.



YOU'LL NEED THIS

SFXR

This is a free download from the internet and it's tiny. You'll also need a set of speakers or headphones.

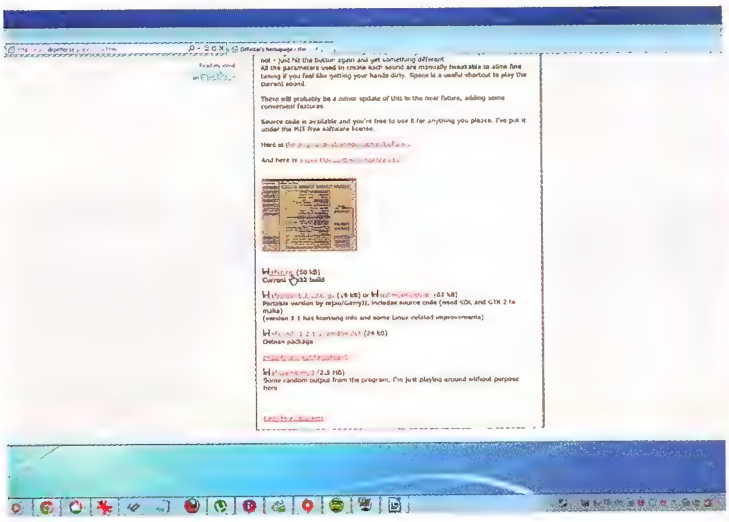
Sfxr began life as a very quick and easy way for video game programmers to add custom sounds to games they had created. The application includes a bank of useful preset sounds, but it also offers an easy way to create unique effects. It works a little like a synthesiser – the keyboard-like instrument that's synonymous with electronic music.

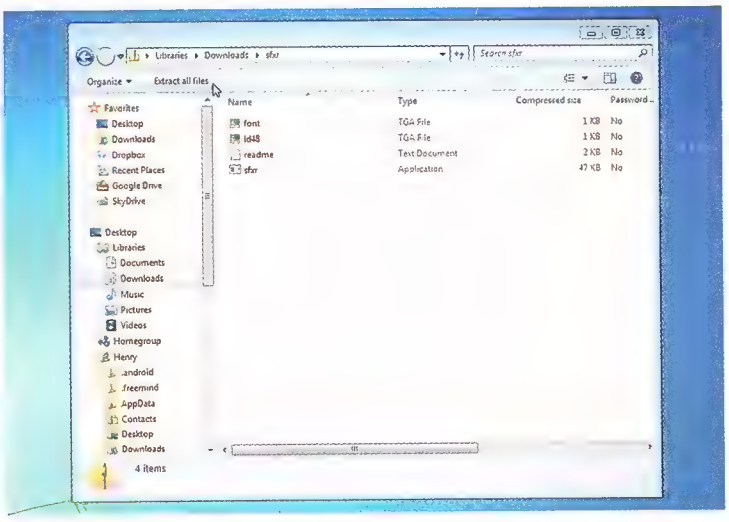
The sounds it creates are short bursts of noise, which are perfect replacements for Windows' own default alerts. Instead of the usual sounds, you can create interesting and unique blips that are activated when opening and closing programs, or when Windows starts and shuts down.

If you love customising your desktop wallpaper or screensaver, then you'll love sfxr. But even if you don't want to change the way your PC sounds, it's still a fun toy and a great introduction to the world of synthesised music.

BECOME AN SFXR MAESTRO

Making sound effects to shut down your system by.





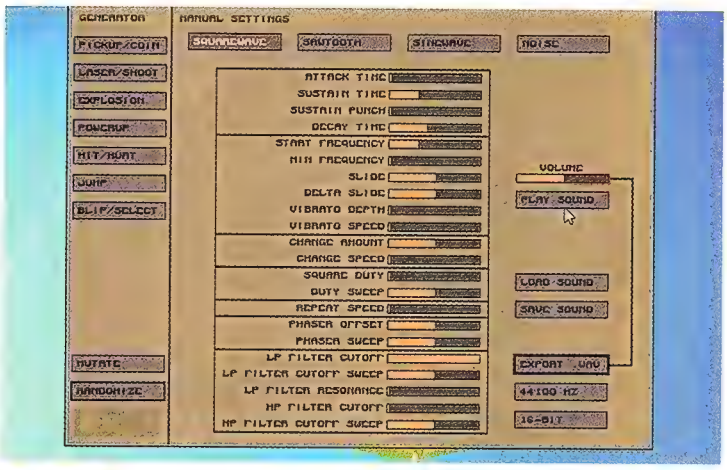
01 GET SFXR

You can download sfxr from **www.drpetter.se/project_sfxr.html**. When the page has loaded, you'll find a bit of backstory on the project (how it was made for the 10th Ludum Dare Competition back in 2007 and so on) and towards the bottom you'll find download links. We want the Windows 32 version, so click 'sfxr.zip'. You can also hear some samples if you click 'sfxdemo.mp3'.

02 SOUND INSTALLATION

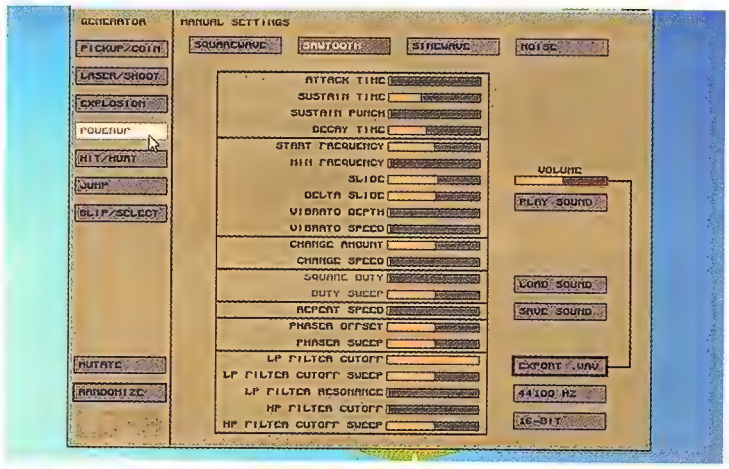
When you're asked whether you want to save or open the file, select 'Open'. The file will download and open automatically. Next, click 'Extract all files' to the upper-left and the files will be unzipped into a new folder. For easy access, right-click on the sfxr application and select 'Send to > Desktop (create shortcut)'. This will create an icon on your desktop.

BECOME AN SFXR MAESTRO (CONTINUED)



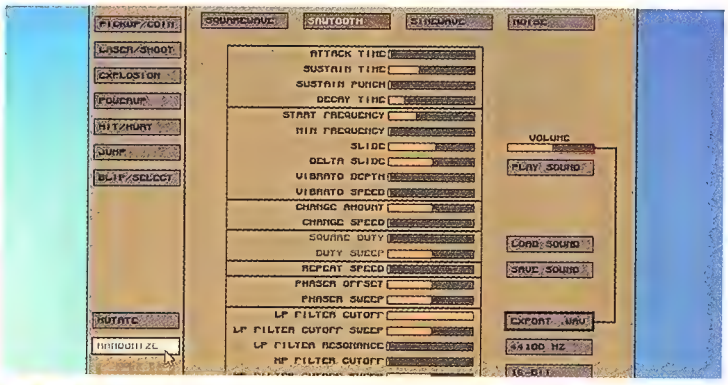
03 VOLUMISING

Next, open sfxr by double-clicking the program's icon. Begin by clicking 'Play sound' to the right. This will play one of the preset noises. If this sound is too loud or too quiet, you can set the volume by clicking and dragging the slider above. Click 'Play sound' again to check that it's OK. You can also play sounds by tapping your keyboard's spacebar.



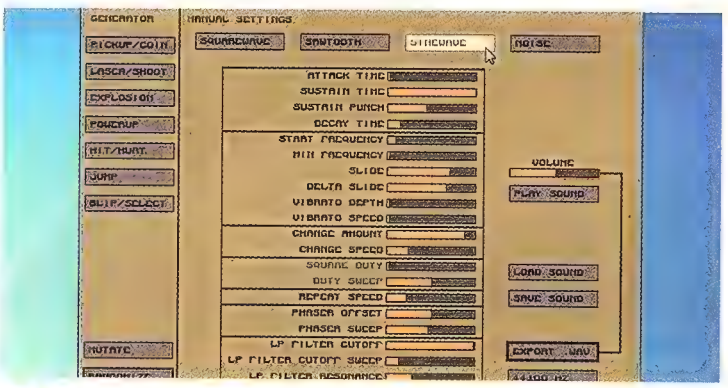
04 THE MUSIC GENERATION

To the left you'll see the generator, which is designed to create random sounds based on a number of common video game actions, such as 'Pickup/Coin' and 'Explosion'. Click on one once and a sound will be generated in the right-hand panel. Click on it again to create another randomised sound. You'll see the sliders change each time you create a new sound.



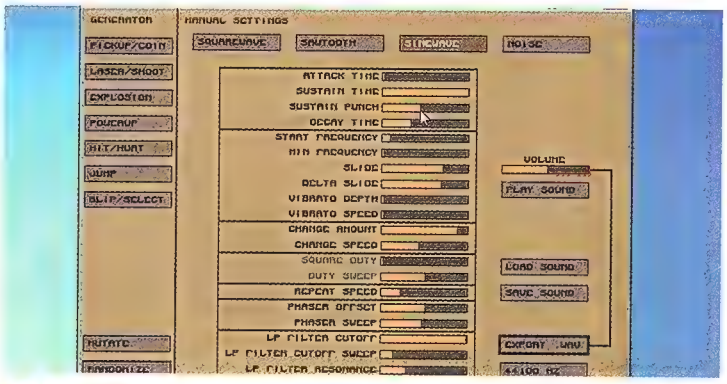
05 MUTATE & RANDOMISE

The 'Mutate' setting at the bottom changes the sound's settings ever so slightly, altering the pitch or tone. If you've created a sound you like using the generator but feel it's lacking a certain something, click the 'Mutate' button until it sounds just right. The 'Randomize' setting throws everything up in the air and creates sounds that range from interesting to unlistenable.



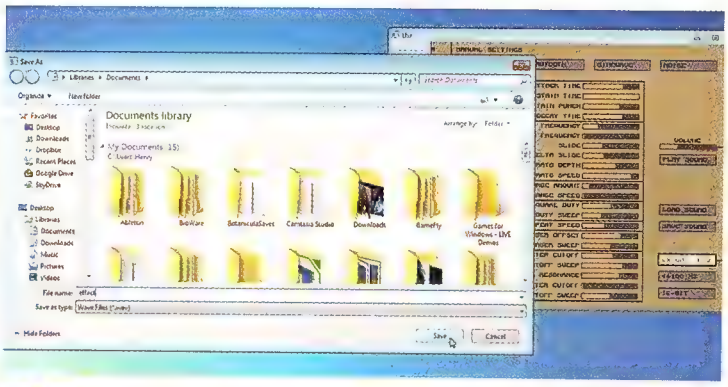
06 MANUAL LABOUR

Now you've seen how the basics work, you're ready to get stuck into the nitty gritty of sfxr. The four buttons at the top – 'Squarewave', 'Sawtooth', 'Sinewave' and 'Noise' – create different types of sound, from techy and clean to messy and noisy. Click one and choose 'Play sound' to hear it, then select another and play it again to listen to the difference.



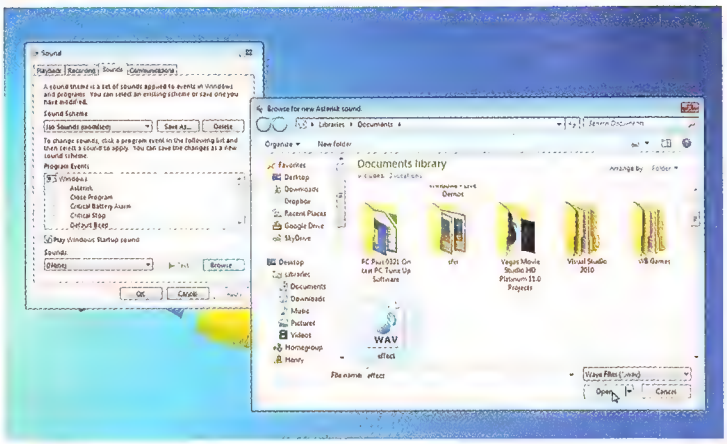
07 SLIDE AWAY

For more control, you can use the sliders to alter a sound's properties. 'Attack', 'Sustain' and 'Decay' set how long it takes for a sound to peak and trough, while 'Start Frequency' allows you to alter its pitch. There are other options, too. Set one at a time and then find the middle ground that sounds just right.



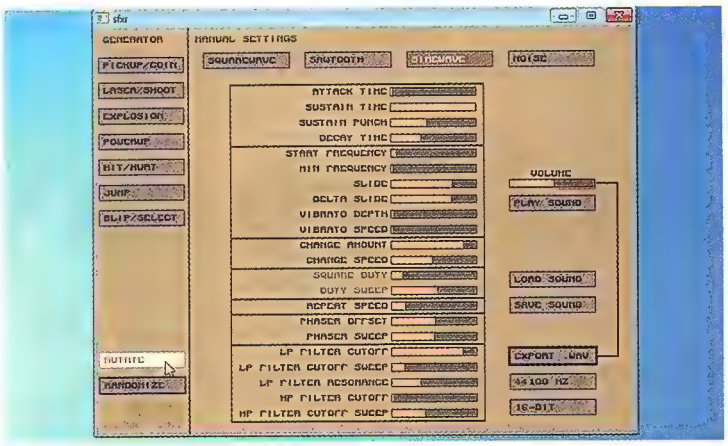
08 SAVE & LOAD

If you have a sound effect you really like, click 'Save sound', choose a directory ('My Documents' by default), type a filename and click 'Save'. If you want to use a sound for alerts in Windows, click 'Export .WAV' and then follow the same procedure. It's a good idea to do both in case you want to change a sound later on.



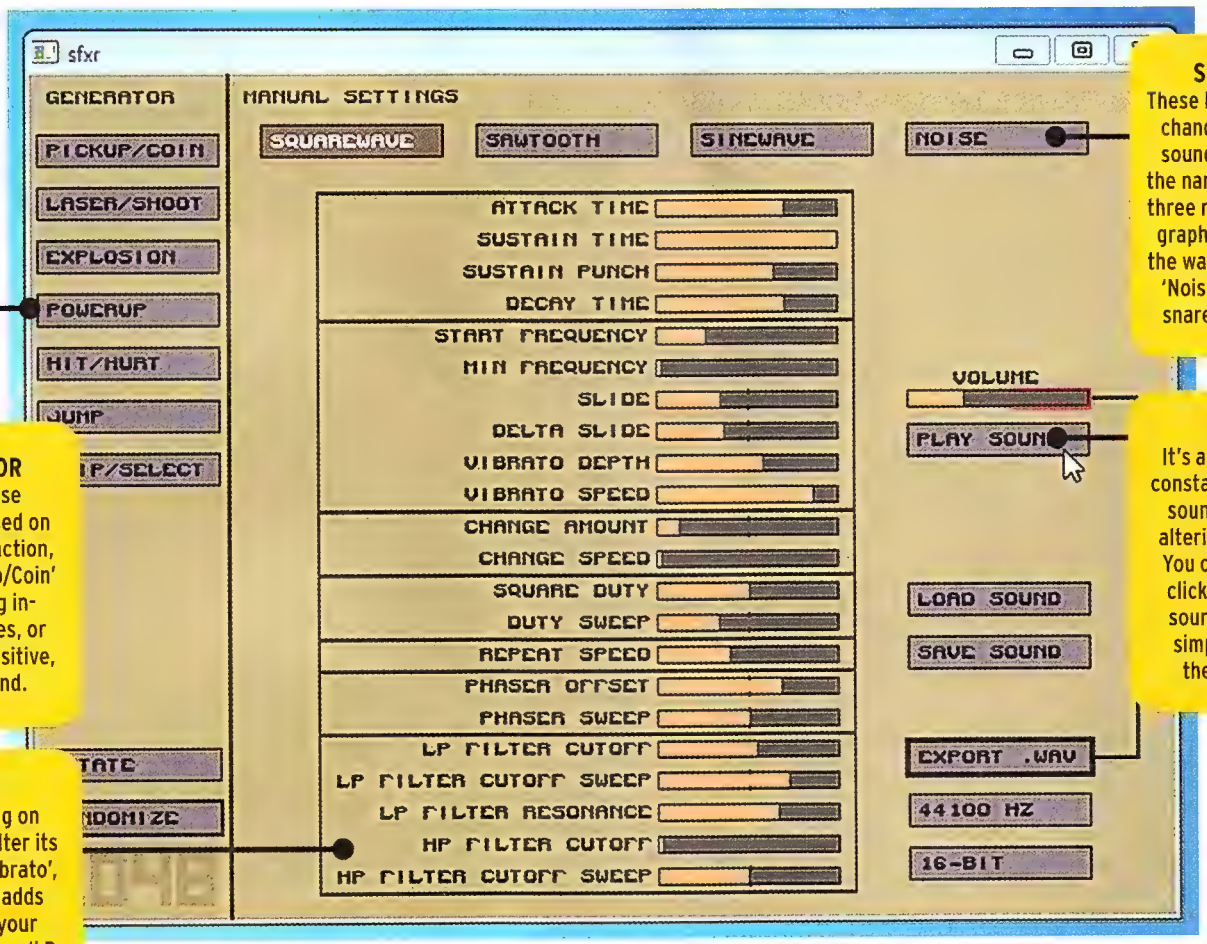
09 NOISY WINDOWS

To play your sounds in Windows, click 'Start > Control Panel > Sound' and then select the 'Sounds' tab at the top. Next, choose the sound you wish to alter (for example, 'Close program'), then click the 'Browse' button and find the sound you created in sfxr. Next, click 'Open' and then 'Apply' or 'OK'. You can change your sounds at any time using this method.



10 SOUNDING OFF

Well done! You now have a firm understanding of every function of sfxr, from creating randomised sound effects to altering levels to make your own custom noises. You also know how to replace Windows' default sound effects with your own. The best way to get to know sfxr is to simply play around with it. It's lots of fun and you'll be surprised by how much you can do.



GENERATOR
Each of these settings is based on a video game action, such as 'Pickup/Coin' for collecting in-game valuables, or 'Jump' for a positive, leaping sound.

LEVELS
Click and drag on each level to alter its properties. 'Vibrato', for instance, adds a tremor to your sounds, whereas 'LP Filter' accentuates the bass.

SETTINGS
These buttons let you change the overall sound of sfxr, with the names of the first three referring to the graphical shapes of the waves generated. 'Noise' is great for snare-like sounds.

PLAY
It's a good idea to constantly play your sounds as you're altering the levels. You can do this by clicking the 'Play sound' button or simply pressing the spacebar.

PART 3

Arduino on your TV

This month, Darren Yates shows you how to hook up an Arduino Uno board to your TV using just three resistors to create your own personal TV weather channel as an example.

PROJECT 3 TV weather channel

APC EXPERT

DARREN YATES

Darren is a multi-award-winning journalist who started building and testing computers in the early '90s. He's developed a range of PC software, including PC User's UserBench benchmark series starting in 2005, its UserOS Linux distros in 2008 and is now working on new benchmarks for Android when he's not busy writing or torturing hardware with his soldering iron.

ELECTRONIC COMPONENTS PARTS LIST

Here's what you'll need to build our TV weather channel.

- Arduino Uno R3 board
- 1kohm 0.5W metal film resistor
- 470ohm 0.5W metal film resistor
- 100ohm 0.5W metal film resistor
- 4.7kohm 0.5W metal film resistor
- DHT11 temperature/humidity sensor
- 1 x RCA socket (available from Jaycar or Altronics)
- 2 x alligator test leads (only if you don't wish to solder the RCA socket)

We started off this Arduino series a couple of months ago, showing you our version of the 'hello, world' project: a digital LED die. Last month, we introduced the concept of multiplexing seven-segment displays and how to use the DHT11 temperature/humidity sensor. So far, the idea has been to show you how the Arduino Uno board and its Atmel ATMEGA328P microcontroller can interact fairly simply with the outside world. This month, we're simplifying the electronics, but ratcheting up the demands on the microcontroller by aiming to hook up our Arduino Uno to the most complicated display output option available: television.

INTRODUCING COMPOSITE VIDEO

Composite video is the least loved video connection system by video purists because it delivers the worst quality (actually, RF-modulated video is worse, but that's another story). Although composite video uses just a two-wire system, it's actually surprisingly complex because it has to incorporate not only the vision data, but also the synchronisation information all on the one video signal. The vision data is the analogue representation, line by line, of what you see on the screen while the synchronisation pulses tell the display device where on the screen to display that data.

Because we have limited processing power, our Arduino can't produce colour and it only has a low 120 x 96-pixel resolution. However, that's still enough to produce text and graphics, and we're going to make use of that this month.

If you go back far enough, you'll remember home computers like the Commodore 64, the Tandy TRS-80 and others, all of which had processors barely pushing 1MHz, but offered colour composite video output you could connect to almost any TV screen. Those computers used considerably more electronics to create the composite video signal. We're going to do to it with just two resistors.

The two resistors connect directly to two pins on the Arduino board — pin 9 produces the sync pulses while the video is output via pin 7. Again, like last month, we're standing on the shoulders of giants and using an Arduino library — Arduino-TVout — to generate the video and sync information.

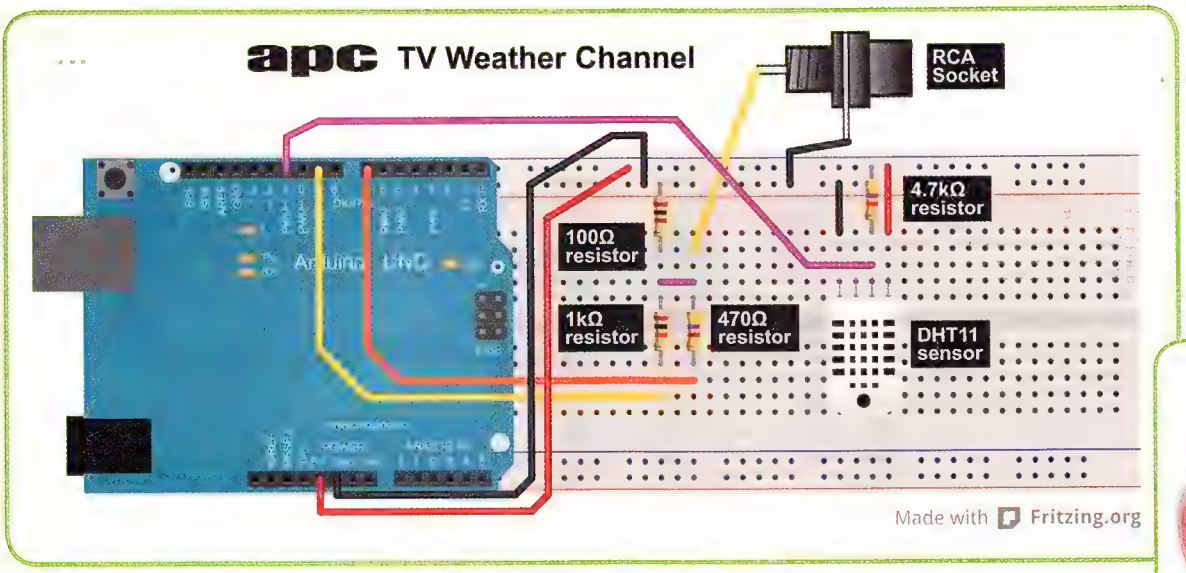
Our TV Weather Channel project's boot screen on your TV.

While you don't need to know how it works internally, it's well worth understanding just a little about composite video so you get a real feel for just how hard the ATMEGA328P has to work.

Composite video for Australian PAL-standard TVs is displayed at the field rate of 50fps or 50Hz. In each field, there are 312.5 horizontal TV lines so that if each field has to take one 50th of a second or 20 milliseconds (ms), those 312.5 lines have to be created in that 20ms, at a rate of one line every 64 microseconds (64µs). Not every one of those lines ends up being visible — 24.5 lines are used for 'blanking' (getting the start of the next field to sync up correctly). In practice, the horizontal resolution of the detail we can get into a TV line, boils down to how many individual pixels we can generate in 64µs. Unlike modern CPUs, the ATMEGA328P runs a fixed 16MHz clock rate or a clock cycle every 62.5 nanoseconds (ns). Compared with the line rate of 64µs, it works out that we get 1,024 clock cycles per TV line.

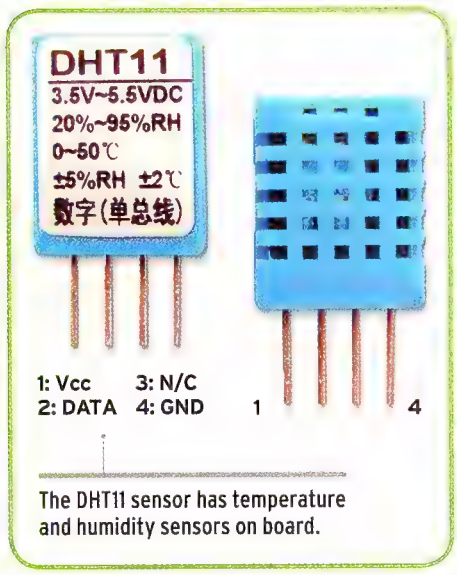
But if we have that many clock cycles, why are we only getting 120 pixels on a line and why only 96 lines in a frame? Well, we're hitting up against another of the ATMEGA328P's limitations. In order to display pixels on the screen, those pixels have to be stored somewhere so they can be quickly retrieved and drawn in each frame. That means storing them in memory. The ATMEGA328P may have 32KB of flash memory, but it only has 2KB of RAM. Given we're using monochrome video only, each pixel only requires 1-bit of storage, so we actually have 16Kb of RAM to play with. Multiply 120 by 96 and you get 11,520 pixels we need to store, which takes up 1,440 bytes of RAM.

The problem is you also need RAM to run your sketches — every integer variable requires 2 bytes of RAM, every string needs 1 byte per character. The highest 4:3 aspect ratio resolution 2KB of RAM could store is only 145 x 109 pixels, and

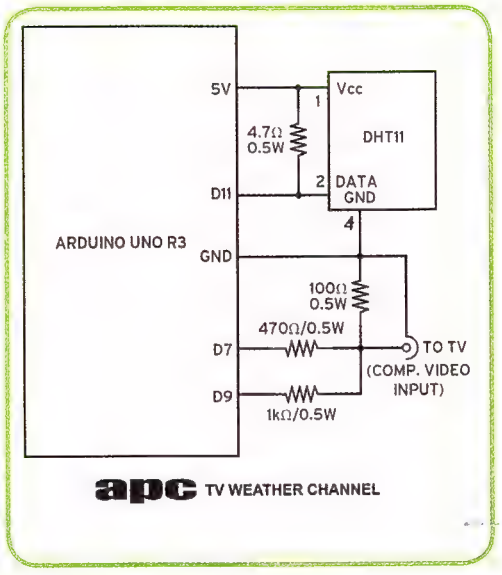


The circuit layout on a breadboard is pretty simple.

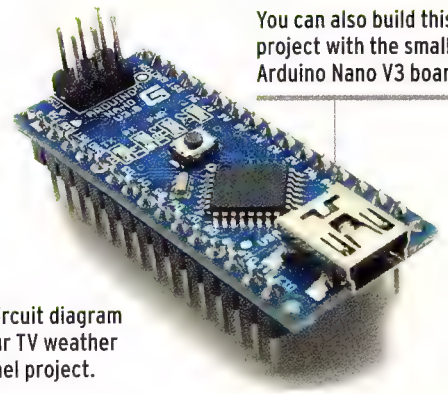
RCA sockets are commonly used with composite video devices.



The DHT11 sensor has temperature and humidity sensors on board.



The circuit diagram for our TV weather channel project.



You can also build this project with the smaller Arduino Nano V3 board.

that's only if we didn't need RAM for anything else. In the end, it's a compromise given the resources at our disposal.

Still, you have to remember the ATMEGA328P was never designed to produce video so huge kudos goes to Myles Metzler, the developer of the TVout library, for getting us this far in the first place.

By comparison, the brand new Arduino Due, which runs a 32-bit ARM Cortex-M3 processor, has 96KB of RAM to play with, which is enough for 1,000 x 750 pixels, plus a decent 84MHz clock rate. That might have you asking why we're sticking with this old 8-bit microcontroller. Putting it simply, the Arduino Uno is the ideal way to learn about microcontrollers — it's very stable, simple to use, easy to program, harder to blow up and a fraction of the cost of a Due.

TV WEATHER CHANNEL

One thing we want some of that leftover RAM for is to gather and display the results from our DHT11 temperature/humidity sensor. We introduced this last month with the seven-segment display version of our weather station, but by creating a video output, we can greatly reduce the component count, get the Arduino to read the sensor and output the data on a video signal it generates. That's not bad going for an old 8-bit micro!

If you take a look at the circuit diagram, it's pretty simple. We've taken the DHT11 sensor, applied 5V to pin 1, grounded pin 4 and taken the data from pin 2 with the 4.7kohm pull-up resistor connected to it. This data is fed into pin 11 on the Arduino.

At the same time, the video output (the data you actually see) comes off pin 7 and the sync pulses (the data that locks the picture on the screen) come from pin 9. And that's it for the hardware. The 100ohm resistor to ground at the output is there to provide better loading, matching to your TV's composite video input.

BUILDING THE CIRCUIT

You can use a standard breadboard on which to build the circuit, although you'll need an RCA socket for the video output. If you're feeling confident, you can take a DuPont wire like we've used here, cut it in half, pull off about 3mm of the insulation and solder each half to the socket connection points. If that sounds too hard, grab a couple of alligator test clips and use them instead. However, if you're seriously interested in electronics and building/hacking stuff, you'll eventually need to learn how to solder.

We're not going to reinvent the wheel here — there are plenty of soldering tutorials online. The one at Instructables (**tinyurl.com/3avsz9**) isn't bad. With practice, you should be able to do a good solder joint within three seconds. The single biggest tip I can give is to keep everything clean — skin oil oxidises on component leads, which can stop solder from wicking onto the lead and causes a cold solder joint. If I'm using components or tinned copper wire that's been lying around for a while, I use a cheap kitchen scouring pad to clean up the wire or lead, just enough to shiny it up, and then the solder takes to it like a duck to water.

Coding the TV weather channel

We show you how to get our weather channel sketch inside the Arduino Uno board to produce your own TV weather channel.

As you may have guessed, by skimping right down on the hardware, we're actually making the Arduino Duo do a heck of a lot in software. To make it easier to code, we've put the whole thing — our sketch along with the TVout and DHT11 libraries — together into a single .ZIP file, which you'll find on our Arduino page at **apcmag.com/arduino.htm**.

Download the file, unzip it and copy the 'apc_03_tvweather' folder to your Arduino sketch folder and the contents of the 'libraries' folder to your computer's '\Arduino_1.0.1\libraries\' folder. Once that's done, start up the Arduino IDE (you can download it from **arduino.cc/en/Main/Software**) and load up the 'apc_03_tvweather.ino' sketch file. Again, we've commented on much of the code to give you an idea of how it works, but truth be told, our sketch is quite simple: the hard work is carried out by the DHT11 and TVout libraries. We're not going to go through it here (an explanation would take up most of the mag), but keeping it simple, the TVout library takes our text information, turns it into pixels, stores it in RAM, retrieves it line by line and then turns it into a video display, which it then piggybacks onto the video synchronisation pulses and sends out to the RCA socket and your TV. And that's the short explanation!

TEXT & BITMAPS

What's so great about the TVout library is that it doesn't require you to do anything complicated like poke your text as individual pixels into specific RAM locations. Instead, it's surprisingly simple (at least for text), thanks to its `print` command: `print(x,y,string);` , where `x` and `y` are the 'x' and 'y' coordinates from the top-left corner and `string` is the text you want to display on the screen. So for example, `print(10,12,"hello world")` would put the text string 'hello world' on the screen, starting 10 pixels from the left and 12 pixels from the top of the display window.

You'll have noticed the *APC* TV weather channel splash image — this is a bit more complicated to create. Arduino Uno has no image compression support and no JPEG or BMP handling, but it understands raw pixels. Here's what you need to do.

Start off with a BMP image 120 x 96-pixels or less and reduced to 1-bit (line art) bit depth. You can do this in most photo/image editor apps from GIMP to Photoshop. The next task is to convert it into a C++/source code array and you can do that with the Image2Code app, which you can download from **tinyurl.com/d2b8hfb**. Launch the app and browse for your image. Select the second option from the right ('MSB----LSB'), tick the 'Invert Image' checkbox on the bottom-left and click the 'Convert' button. Windows Notepad will then launch and give you a C++ array of data. If you look at the Arduino IDE after loading up our APC_03 sketch, open up the 'apclogo.cpp' tab and you'll see a similar array with hexadecimal numbers. Copy the data from Notepad to the 'apclogo.cpp' tab and overwrite the original array. Make sure you remove the parentheses `{` and `}` at the start and end of each line, along with the empty lines between each array line.

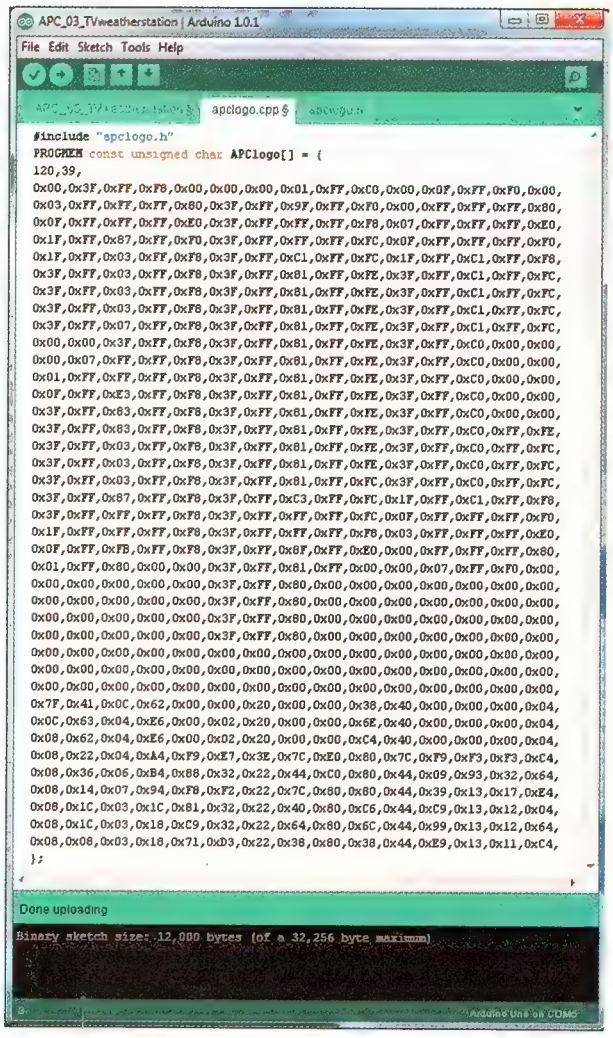
The last thing you need to do is set the image dimension at the very top of the 'apclogo.cpp' file. Simply change the `104` and `42` numbers to match the horizontal and vertical dimensions of your original BMP image (any decent image editor will tell you this information).

Save it and when you launch the sketch in your Arduino Uno, provided you have the TV circuit wired correctly, you should see your image appear on your TV screen. What we're doing is storing the image as raw pixels in flash memory, of which we have buckets, compared to RAM.

SETTING SCREEN RESOLUTION

Another thing that's quite interesting with the TVout library is that you actually get to set the output resolution. Keeping in mind the 2KB RAM limit, you can choose the screen resolution using the `begin(mode,x,y)` command. So by using `TV.begin(1,120,96)` , we're telling the library we want to create a PAL-standard video output (1 for PAL, 0 for NTSC) with 120 pixels horizontally by 96 vertically.

To change the resolution, you just change the 'x' and 'y' values. Just be sure that the 'x' size is divisible by eight or it won't work. There's excellent documentation for this library over at **tinyurl.com/27f7haz** and it's well worth a read. If only the ATMEGA328P had more RAM!

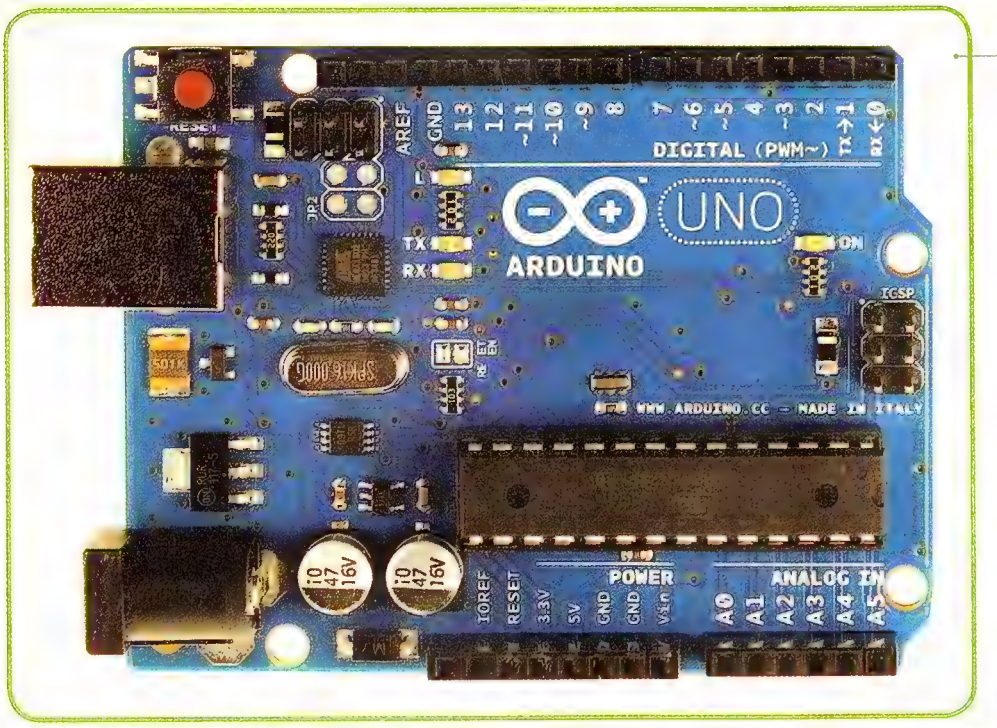

APC_03_TVweatherstation | Arduino 1.0.1
File Edit Sketch Tools Help
apclogo.cpp §
#include "apclogo.h"
PROGMEM const unsigned char APClogo[] = {
120,39,
Done uploading
Binary sketch size: 12,000 bytes (of a 32,256 byte maximum)

The boot screen image is raw pixel data, stored as a file in flash RAM.

The main channel screen: basic yet effective.

HOW THE SKETCH WORKS

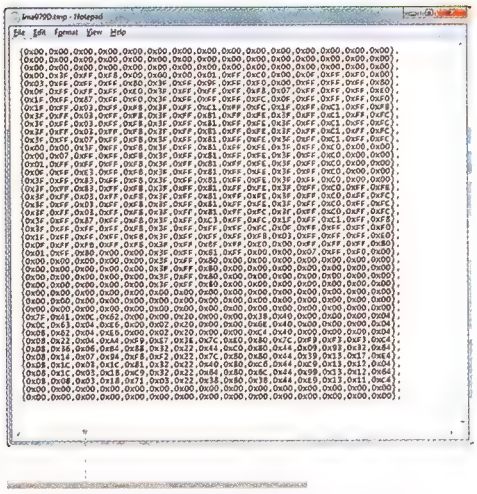
The *APC* splash screen appearing for a few seconds might seem like a huge dose of vanity, but like all good programming should, this is just



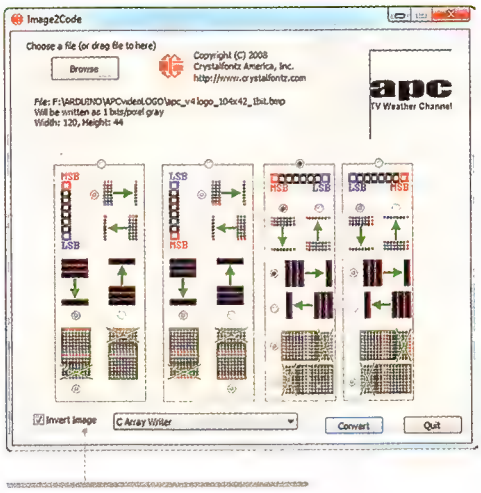
The Arduino Uno R3 microcontroller board makes this project possible.

ARDUINO ISN'T FUTURE-PROOF

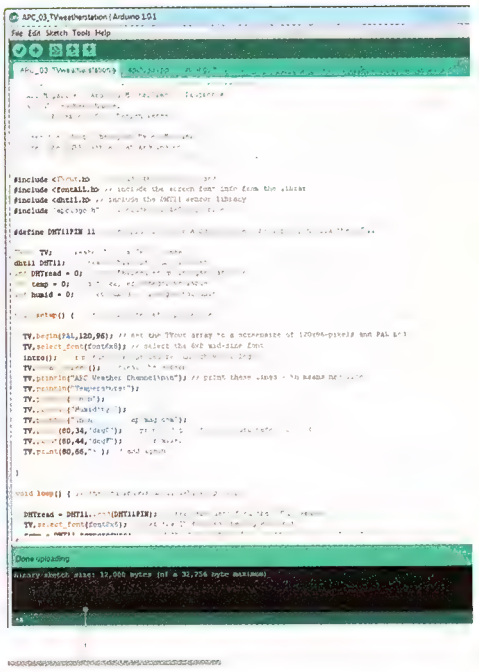
Not even Arduino is immune to price pressures of newly released products. Just like laptop and desktop CPUs, the arrival of the ARM-based Arduino Due and the uprated ATMEGA32U4-based Arduino Leonardo has seen prices for Arduino Uno boards drop to as low as $13 on eBay. Sure, the Uno isn't as powerful, but given the things you can learn from it, it's money well spent.



Copy the notepad contents to the Arduino IDE to create your own images.



Create the raw pixel data through the free Image2Code app.



You program our sketch code using the Arduino IDE.

masking what we're doing in the background. The DHT11 sensor actually needs a few seconds to wake up, take a few readings and start producing meaningful numbers. So by having the splash screen, we're showing the circuit is awake and giving the DHT11 time to boot up at the same time. Once we get to the main `loop()` procedure, we simply call the `DHT11.read` procedure to get the data out of the DHT11 sensor, grab the Celsius temperature, calculate the Fahrenheit temperature from that, note the humidity reading and then print those to the screen. Then, we wait a few seconds and do it all again.

What we're doing here is only printing the screen data that changes — the actual temperature and humidity readings — rather than rewriting the whole screen. Apart from producing untidy blips on each rewrite (we don't have the benefit of double-buffering the video frame here), we're actually pretty close to running out of RAM. Remember how I said before the 120 x 96-pixel screen window uses up most of the RAM? By the time we account for the DHT11 library and our own sketch, there's barely any bytes left to scratch together. That's more than enough for our needs, so the whole thing works.

MAKING IMPROVEMENTS

The DHT11 sensor is pretty cheap and you'll find it on eBay for around $2 shipped. However, it's only good from zero to 50°C with +/-2° accuracy and 20 to 95% humidity with +/-5% accuracy. Spend around $6 and you can grab the uprated DHT22, with its wider -40 to +80°C range (+/-0.5°) and zero-100% humidity (+/-2%). You'll need to rewrite the DHT11 part of our sketch code and include the DHT22 library, which you can grab from the Arduino web site (we'll leave that as an exercise for you to do).

GIVE IT A GO

Television is about the most complex output display device you can get. While we don't have enough horsepower to build a complete computer system, it shows just how powerful this simple 8-bit microcontroller is, that it can display text and data on a TV using little more than a couple of resistors and an RCA socket.

In fact, we're not done with video on the Arduino Uno and hopefully, this has sparked your own imagination into ways you can use video in your own designs. apc

New mini PCs

A new Raspberry Pi has arrived, with 512MB of RAM for the 256MB price. Darren Yates looks more at these tiny ARM-powered computers.

APC EXPERT

DARREN YATES

Darren is a multi-award-winning journalist who started building and testing computers in the early '90s. He's developed a range of PC software, including PC User's UserBench benchmark series starting in 2005, its UserOS Linux distros in 2008 and is now working on new benchmarks for Android when he's not busy writing or torturing hardware with his soldering iron.

The super-cheap PC revolution is built around ARM-designed processors licensed to various manufacturers, including Chinese brands Allwinner and Rockchip. In the wider sphere, ARM is powering the smartphone and tablet takeover of personal computing.

In the last month, ARM Holdings held its TechCon 2012 conference and announced details of the first 64-bit ARM processor cores using the equally-new ARMv8 architecture — the Cortex-A53 and A57. These will eventually take over from the current new Cortex-A7 and A15 designs now starting to hit the streets in Google's new Nexus 10 tablet and the Samsung Chromebook.

According to ARM, the A53 will deliver the same performance as today's Cortex-A9 chips (used in the Nexus 7), but be only one-quarter the size and use a quarter of the power. The big A57 will deliver three times the current 2012 smartphone peak performance, although it's scalable to beyond 16 cores. The chips will be manufactured on a tiny 20-nanometre scale.

Adding to this is the news that chip maker AMD will introduce ARM technology into its server-focused Opteron lineup for the first time. It's a significant milestone for ARM in its battle with Intel in the server market.

NEW ATOM MINI PC

While netbooks have all but disappeared in the face of the ARM-based tablet onslaught, their Intel chip of choice is joining the mini PC revolution. The original Atom N270 processor has been spotted inside a new aluminium chassis-based mini PC created by Chinese thin client developer Kingdel.

Called the NC270, the compact unit features 1GB of RAM and an 8GB SSD; however, it's apparently expandable with a SATA II port and will run any standard x86 operating system, including Windows. The price? At the beginning of November, units were available on **Aliexpress.com** for $132, including shipping. In terms of size, the NC270 isn't much larger than a typical ADSL router, yet it's not likely to match the 5W typical power drawer of most ARM-based mini models — the unit apparently comes with a 12V/48W PSU.

What's not clear is the GPU being included. The Atom N270 doesn't have an integrated GPU and no mention is given in the NC270 specs. That means H.264 video decoding may only be 720p at best, which still makes the ARM-based Android-flavoured mini PCs the better option for now.

MK808/UG802 PROBLEMS & FIXES

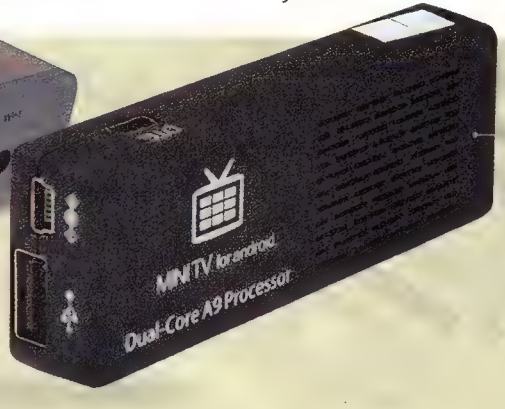
Despite its potential, we weren't overly thrilled with the new dual-core MK808 mini PC in our review last month and it turns out we're not alone, with plenty of other users also noting issues. Unfortunately, the MK808 and its cousin, the UG802, have problems: the MK808 only delivers 1,024 x 720-pixel resolution by default, while the UG802 has a Wi-Fi/USB problem where using USB storage shuts down the Wi-Fi module.

Rockchip's RK3066 dual-core chip has made it into several other mini PCs including the new fourth-generation MK802 III, UG007 and a couple of others. For the time being, we think the Raspberry Pi, MK802 and CX-01 mini PCs are the best bets in terms of usability and reliability, but we're still confident dual and quad-core mini PCs will eventually hit the mark.

The good news for MK808 and UG802 owners is that there are now new community ROMs available at **FreakTab.com**, which look to overcome at least some of these issues. Developed by **FreakTab.com** administrator Finless, the latest 1.5A ROM for the MK808 improves Wi-Fi speed up to 65Mbps, removes the unnecessary Chinese apps to boost available storage and increases screen resolution to 1,280 x 672 pixels. So far, early reports are positive. A similar ROM for the UG802 based on the new MK802 III also appears to be getting a positive response.

More promising is the news that work is progressing on getting Ubuntu 12.10 Linux running on the RK3066 chip with the hope of a dual-boot ROM becoming available. Whether it's loadable via a microSD card isn't clear at this stage, although we'll know more in coming weeks.

Kingdel's NC270, a 1.6GHz Intel Atom N270 mini PC for $132 shipped.



The new Finless 1.5A ROM fixes a number of the MK808's woes.

8/10 @ www.miniand.com $ US$89 (1GB version) ✔ Very compact design, 1GB of RAM, external Wi-Fi antenna. ✖ A bit pricey for a single-core mini PC.

9/10 @ au.element14.com $ $38 plus shipping ✔ Huge community support, 512MB of RAM, same price. ✖ ARMv6 architecture (no Ubuntu).

7/10 @ www.ebay.com.au $ $27 ✔ Uses AAA batteries, 2.4GHz receiver included. ✖ Keyboard keys aren't much more than membrane buttons.

Miniand Mini Xplus TV Box H24

If you're looking for the smallest mini PC on the market, we're pretty certain this is it. The Mini Xplus H24 also goes by the moniker MK806 online, and it's an impressive little unit that delivers more features than a MK802. With two full-size USB 2.0 ports, a microSD card slot, full-sized HDMI output, dedicated DC socket, composite video output and external 802.11b/g/n Wi-Fi antenna, you'll struggle to find a mini PC of this size with more. It runs Android 4.0.4 on Allwinner's popular single-core A10/Cortex-A8 processor and includes 1GB of RAM and 4GB of flash storage. Being an A10-based device, you can dual-boot it with Lubuntu 12.04 (Ubuntu with LXDE desktop) via a suitably formatted microSD card, just like the MK802, though the already lean Lubuntu 12.04 OS isn't exactly quick here. The H24's Android benchmark results are on par for an A10 chip and we also had the Big Ben PS3 Parental Controller wirelessly connected, running *Beach Buggy Blitz* with no need for keylayout modding. However, the A10 could use a little more frame speed. Buying from Miniand means you're buying locally with a one-year warranty and the extruded aluminium chassis makes it as tough as nails. Few devices this size will give you two full-size Type A USB ports.

Raspberry Pi 512MB

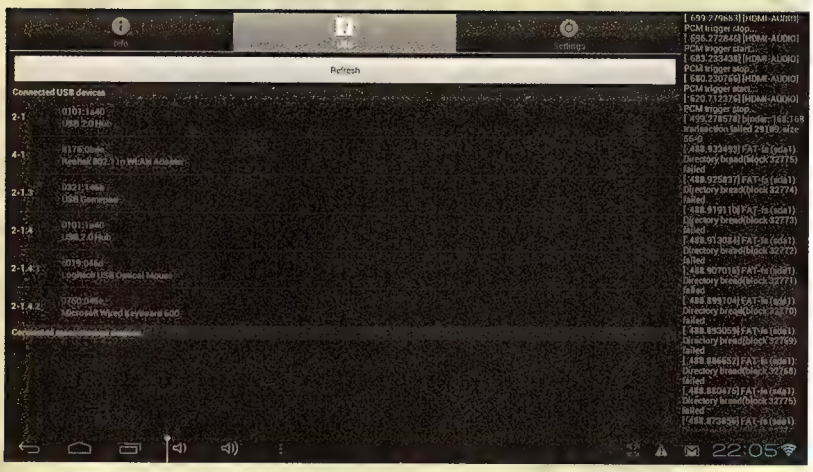
The original Pi had two main issues: its relatively low 700MHz clock speed and its smallish 256MB cache of RAM. Since its release, factory-backed overclocking to 1GHz has become a reality and the RAM issue has now been addressed with this new second-gen Raspberry Pi with 512MB of memory. This UK-manufactured board also includes a couple of welcome mounting holes for easier installation. We tested this out with our 3D printed case and it slotted in perfectly. Just make sure you get the new October 28 Raspbian OS update (**raspberrypi.org**) — you'll need it to access the new 512MB memory cache. That RAM does make a difference, particularly booting into the LXDE desktop. By the time you go from the original stock 700MHz/256MB Raspberry Pi with the Debian Squeeze OS to an overclocked 1GHz/512MB version with floating point Debian Wheezy, you're getting a bench tested performance boost of approximately 39% — not a bad effort. However, booting from a command prompt to the desktop is improved by 178% on the first go and 60% thereafter. It's still down by about 15% on the speed you can get out of an MK802 mini stick, and it lacks a GPU, but with H.264 video acceleration, it's still impressive.

Measy RC11 Fly Mouse

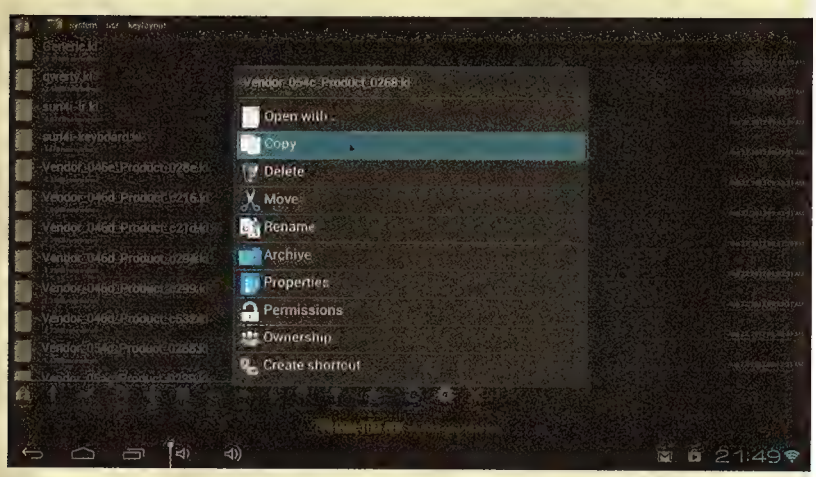
Remote-controlling your mini PC is something there are multiple ways to achieve. One standalone method is to use a 2.4GHz wireless keyboard. We looked at the Logitech K700 last month and while it does the job, it's better suited as a proper desktop keyboard. If you're considering something more for the lounge room, this Measy RC11 is commonly bundled with the MK802 on eBay for around $75. We picked up ours on its own for under $30. Setup is as simple as you can get: plug the 2.4GHz receiver USB dongle into the MK802's USB port (either direct or via a hub), whack three fresh AAA batteries into the Fly Mouse, boot up your MK802 and away it goes. You'll find the USB receiver dongle tucked inside the battery compartment. There are two versions of this mouse: this RC11, which is split into a two-hander control, or the RC12, which is more a mini version of the Logitech K700. The difference here is the built-in accelerometer that allows you to move the mouse by just holding the RC11, pressing the centre Android button and waving it in the air. The keyboard itself uses stiff microswitches that, while functional, aren't speedy to use. Still, it does the job for a reasonable price.

Get console gaming on your mini PC

Get a special bargain PS3 gaming controller working on your MK802 and Mini Xplus H24 mini PCs.



USB Host Controller shows the Vendor/ProductID of connected USB devices.



Make a copy of the PS3 keylayout file in the \system\usr\keylayout\ folder.

It's the computer that just keeps on surprising. It started out as the first computer in a USB stick, the first to dual-boot with Ubuntu 12.04 and the first under $50 (OK, apart from the Raspberry Pi). Now you can add wireless console gaming to the tiny MK802's list of accomplishments, all thanks to a discovery we made this month involving a recent addition to EB Games stores. It does need just a little work from you, but it's the first wireless gaming controller we've seen work with the MK802 — what's more, it'll cost you less than $20. And it's even easier to get working on the Mini Xplus H24.

ANDROID & CONTROLLERS

You might not be aware, but starting with Android 3.1, Google quietly began adding support for game controllers into its mobile OS. The search giant didn't make a huge song and dance about it, other than to say that you can now use wired Xbox 360 and PlayStation 3 game controllers on Android devices. But in practice, the whole game controller thing on Android is still a bit of shambles, as it's up to the Android device's ROM developer to include it.

PARENTAL CONTROLLER

When you're working with a $50 mini PC, the last thing you want to do is blow $75 on a Sony DualShock 3 controller. And as it turns out, the DualShock 3 doesn't work with the MK802 or the Mini Xplus H24, although it does work well on name-brand Android tablets (I've covered this in the January issue of *TechLife*). So, I started trawling the web for cheaper, generic options and came across the wholly unfashionable Big Ben PS3 Parental Controller. Actually, it's a terrific idea for parents struggling with their kids' gaming obsession — it provides a six-key master password that a parent activates, switching on the controller for a parent/child agreed time limit. Once the timer goes off, so does the controller. It sounds like it's gaming hell, but before you look down on it from too great a height, read on.

First up, the time limit can be set to a maximum of four hours. On a PC or console, I'd be less interested, but four hours of continuous gaming on Android is enough for me. Even then, turn it off and on, enter the code and you're up for another four hours.

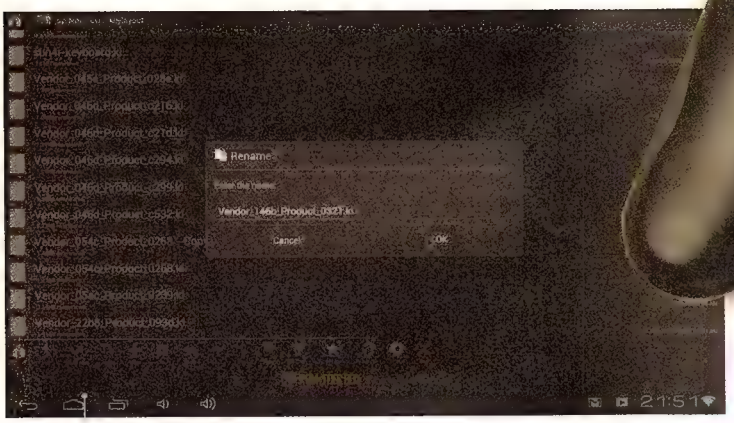
But here are the best bits: EB Games has it for just $18, which makes it cheap enough to mate with a $50 MK802 and still come out with change from $70. But not only that, it's 2.4GHz wireless. It comes with a USB dongle and for all intents and purposes, the Android device thinks it's connected to a wired controller. The only trick is making sure the switch on the dongle itself is set to 'PC', not 'PS3'. And before you ask, I have no idea why, but it doesn't work if it's set to 'PS3'.

The first thing you do is plug the USB dongle into a spare port on your USB hub. Next, install the two AA batteries into the controller and turn it on. Straight away, it'll beep and ask for a password (the default is 423124 using the right-hand pressure buttons. The default timer period is 15 minutes), but read the manual for instructions on how to permanently set this to four hours (or whatever time you want).

VENDOR/PRODUCT .KL FILES

However, using the parental controller only gets us halfway. Although Android supports wired Xbox 360 and PS3 controllers, plug them into the MK802, MK808, CX-01 or Mini Xplus and they don't work.

Game controllers are part of Android's slowly growing list of Human Input Devices (HIDs), which also includes keyboard and mice. These HIDs are generally controlled in Android by special code drivers called 'kernel



Rename the copy to match the Parental Controller's vendor/product ID.

modules' and typically appear as .KO files. These are compiled against the particular build of Android being used to ensure they work. To get these working as input devices, Android simply reuses its keyboard keymapping setup, where buttons and switches are mapped to key numbers in special keylayout (.KL) files that live in the \system\usr\keylayout\ folder. These files have a special naming convention to make them easy to load, based on the international vendorID/product ID code.

All USB peripheral manufacturers sign up for a four-digit hexadecimal vendor ID, given to them by the USB Implementers Forum (USB-IF). For example, Microsoft's is '045e'. Each manufacturer then gives their products a similar four-digit hexadecimal product ID. Microsoft's original Xbox 360 controller has a USB product ID of '028e'.

So by using the 'Vendor_xxxx_Product_xxxx' name for the keylayout files, Android can quickly load the correct keymap to suit a particular HID, based on the device's handshaking information when you first connect it to the USB host port. You'll generally find a 'Vendor_045e_Product_028e.kl' file in most Android ROMs, which is the keymap layout for Microsoft's Xbox 360 controller. 'Vendor_054c_Product_0268.kl' is the one for Sony's PS3 controller.

But why don't genuine PS3 or Xbox 360 controllers work if the keylayout files exist? The reason is because the kernel module drivers are typically missing and based on my experience, they seem to only get included in name-brand Android devices. These mini PCs include generic controller kernel modules. That said, we have two problems: first, we don't know the vendor/product ID of our wireless controller, and second, you can be sure we don't have a keylayout file for it.

To solve the first problem, we need USB Host Controller from Google Play, which is an excellent USB enumeration tool that shows up everything connected to your device's USB port, including its vendor/product ID. Install the app, plug in the controller's USB dongle to your powered USB hub and fire up the app. Click the app's 'USB' button and look for 'USB Gamepad' in the entry. Just above, you'll see '0321:146b' — that's the product ID:vendor ID code for our Parental Controller.

Next, we need Root Explorer Lite, also free from Google Play, which allows you to go snooping around your Android device folders. The trick here is you need root access for this to work — the beauty is the MK802 comes pre-rooted. Most mini PCs can be rooted now if yours isn't. Install the app, fire it up and head to the \system\usr\keylayout\ folder. Look for 'Vendor_054c_Product_0268.kl', the keymap file for the Sony PS3 controller. Using Root Explorer Lite, make a copy of the file, save it in the same folder and rename it 'Vendor_146b_Product_0321.kl'. In short, what we're doing is using the PS3 controller keylayout file, but making it fit the vendor/product ID of our wireless controller.

AND IT WORKS!

Once you've done that (and you only need to do it once), make sure you flick the dongle switch to 'PC', turn on the wireless controller and it should work. At the moment, my test app of choice is *Beach Buggy Blitz* and although the MK802 could use a few more herbs on its GPU, the whole process works surprisingly well — you can even use the left analogue control to navigate through the Android launcher. Games must have built-in controller support for this to work, so get the free TegraZone app from Google Play and search for controller-ready games.

The Big Ben PS3 Parental Controller, a wireless PS3 controller for under $20.

The MK802 can use this PS3 controller, but could use a bit more GPU speed.

Beach Buggy Blitz, a great free driving game with controller support.

Head to 'Settings/Controls' and select 'Gamepad' to change controller assignment.

HTML PART 5

Contemporary web designs with CSS3

In our continuing HTML5 masterclass, John Allsopp explains how CCS3 can visually enhance your web designs.

APC EXPERT

JOHN ALLSOPP

With a background in computer science and mathematics – and a great deal of good fortune – John Allsopp's life collided with the web in the early '90s. For nearly 20 years he has developed software for web developers, built web sites and apps, and written books, countless articles and tutorials for print and online publications. In 2000, he wrote *A Dao of Web Design*, which over a decade later continues to be widely cited as the theoretical foundation for Responsive Web Design.

Web design has come a very long way since the 'killer web sites' days of tables, spacer GIFs, images for text and all kinds of hacks to create rounded-corner elements in web pages. While we've long known that best practice in web development is to separate our structured content (in HTML files) from our presentation (in CSS), until quite recently a number of visual design effects have required that we pollute our markup with extraneous elements, and use images purely decoratively to achieve them. But help is at hand with a whole raft of CSS3 features, now very widely supported in modern browsers. In this instalment, we'll take a look at how we can add visual delight to our designs, without touching our pristine semantic markup.

ROUNDED CORNERS

You might be surprised to learn just how far back rounded corners go in web design, as I've found examples from as early as 1996, which is when the Wayback machine at **archive.org/web/web.php** (an archive of much of the internet) started indexing the web. For over a decade, there was only one way to create this kind of design, using images and extraneous markup. But with CSS3, we have the `border-radius` property, letting us create rounded corners for one or more of the corners of any element.

All we need to do is use the `border-radius` property with a length value (length values in CSS are numbers with units, like px, or em). For example, here we'll add a 10px rounding to each corner of every paragraph.

```
p{
        border-radius: 10px;
        background-color: #c1c1c1
}
```

And here's what our paragraph will look like.

So now all we need to do is use the `border-radius` property, with a length value (length values in CSS are numbers with units, like px, or em). Here for example, we'll add a 10px rounding to each corner of every paragraph.

We're likely to want to add padding to create some space between the border and its content, but that's all we need to do now to add rounded corners to any element.

But wait, there's more. We can apply rounding to individual corners using properties of the form `border-top-left-radius`. Here, we'll add a border-radius to the bottom-left and top-right corners of a paragraph.

```
p{
        border-top-right-radius: 10px;
        border-bottom-left-radius: 10px;
        background-color: #c1c1c1
}
```

Of course, we can also have different roundings for different corners, simply by changing the value of the `border-radius` for that corner. There's more still to `border-radius`, so if you're keen, head over to the ever useful CSS-Tricks (**tinyurl.com/a2s2yhy**), where you can learn how to make buttons that look like this:

TRANSPARENCY

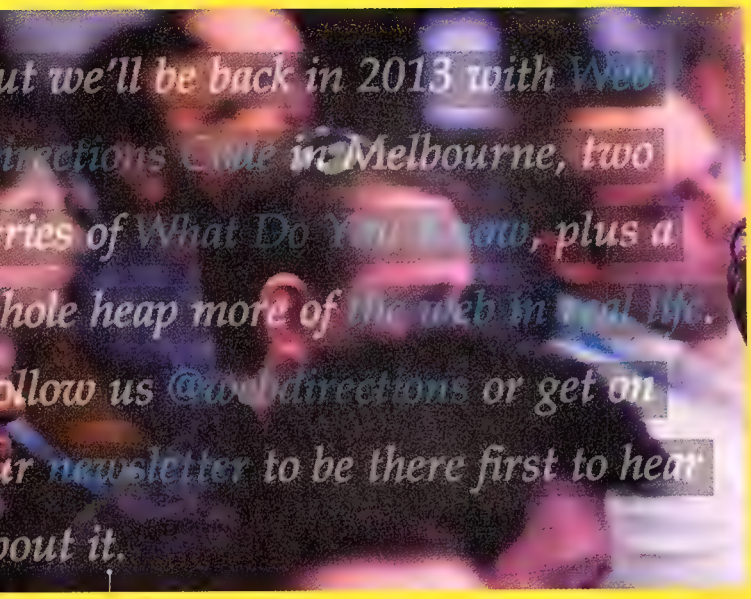
Rendering engines have literally for decades been able to composite elements semi-transparently on top of one another. Well, except on the web, where just about no amount of hackery could help us emulate this. However, CSS3 provides a couple of ways of using transparency. First up, we can make an entire element (including its content, background and border) semi-transparent, using the `opacity` property. This takes a value between 0 and 1, where `opacity: 0` means completely transparent, `opacity: 1` means completely opaque and `opacity: .5` means 50% transparent.

By itself, opacity is of limited use, as we can see from the example below. Because opacity applies to the entire element, the text is semi-transparent, making it difficult to read. In a moment we'll look at how we can make some features of an element transparent, but not all of them, so what exactly is `opacity` good for?

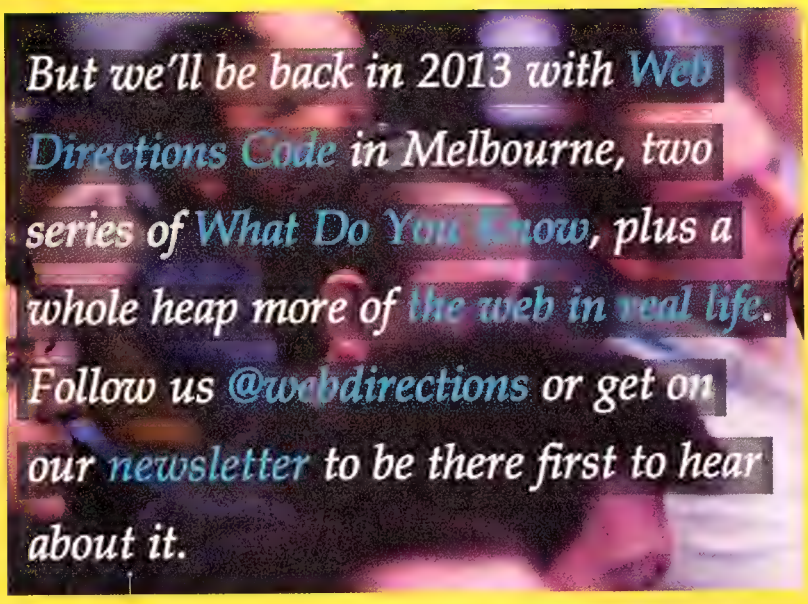
Well, it's great for animating the appearance and disappearance of elements, an increasingly common interaction pattern these days; for instance, popping up a warning or further information. While we can't replicate such effects in print, of course, just paste this little bit of CSS into a style sheet and then anytime you hover over a paragraph, it will vanish:

```
p:hover {opacity: 0
}
```

OK, so it's not super exciting, but just wait until we get to animations using CSS in a couple of months!



Here's a paragraph with opacity: .5 .


But we'll be back in 2013 with Web
Directions Code in Melbourne, two
series of What Do You Know, plus a
whole heap more of the web in real life.
Follow us @webdirections or get on
our newsletter to be there first to hear
about it.

A semi-transparent background colour using RGBA.

The other way we can use transparency in our designs is by using RGBA colours for backgrounds, borders or text. In short, anywhere we can have a colour value, we can use RGBA.

RG WHO NOW?

You're probably familiar with using CSS values like `#11ff55`, where we have three pairs of numbers corresponding to the red, green and blue values of the colour, between 0 and 255, expressed in hexadecimal. So, for our example:

red = 11 hex = 17 decimal
green = ff hex = 255 decimal
blue = 55 hex = 85 decimal

RGB colours (we'll get to the 'A' part of RGBA in a second) specify colours using the same model, just using different syntax. Again, we use three values (one each for red, green and blue, each between 0 and 255), although we express these as decimals. So, `#11ff55` is expressed as `rgb(17, 255, 85)`. Same colour, just different syntax.

And what about the 'A' in RGBA? Well, that's for the alpha channel, or degree of transparency. It's a number between 0 and 1 that, like `opacity`, specifies how transparent this colour should be. Here, instead of the element itself being transparent, we've made only the `background-color` semi-transparent with the following code:

```
p {
background-color: rgba(33, 31, 35, 0.5);
}
```

You can see an example of this in the image above. Now that the text isn't semi-transparent, it's far more legible.

Lastly, you might be wondering how we can have semi-transparent background images without using `opacity`. Well, we've long been able to do this using transparent PNGs.

SHADOWS

Along with rounded corners, one of the longest-standing design effects developers have hacked up for the web has been the use of shadows, both for text and for whole elements. CSS3 introduces both of these features. First, we'll take a look at how we specify a shadow, then look at how we can use these with text and then whole elements.

In CSS, a shadow is specified using the following:

A horizontal offset: less than zero and shadows appear to the left of the object, as though a light source were on the right of the object; greater than zero and shadows appear to the object's right.

A vertical offset: less than zero and shadows appear above the object, as though a light source were below it; greater than zero and shadows appear below the object.

A blur value: the higher the blur value, the more diffuse the blur.

A `color` value for the colour of the shadow. This can be semi-transparent if we use an RGBA colour.

These four values apply to both text and box shadows. In addition, for box shadows we can also specify:

A spread value: this increases or decreases the footprint of the shadow.

The keyword `inset`: this specifies a shadow should be inside the element, not outside it (the default).

Putting these all together, here's what a simple `text-shadow` property might look like: `text-shadow: 5px 5px 3px red`: will look something like this:

Some text with a blurred red shadow

Note how the red shadow is quite blurred, and is offset to the right and down from the text.

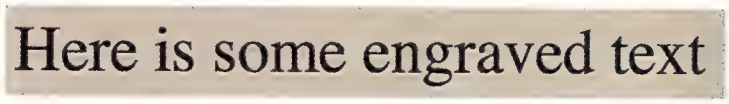
OK, it's not the most attractive use of shadows, but let's see some more useful examples. We'll start with text. We use a shadow value, as outlined above, with the `text-shadow` property, to apply shadows to the text of an element. Let's take a look at a few common text shadow effects to see how they're used.

* **Engraved text**. Engraved text is styled by having text darker than

its background, and a shadow with little or no blur, offset horizontally as if the light source were above the text:

```
p.engraved {
        background:#999;
        color: #333;
        text-shadow: 0px 1px 0px #ddd;
}
```

And here's an example.



* **Embossed text**. This embossed text effect demonstrates that text and elements can have more than one shadow. In theory, they can have any number of shadows; in practice, some browsers have limits as to how many they'll support. Shadows can also impact the performance of mobile browsers in particular, so it's worth using them a little judiciously. Here we use two separate shadow values, separated by a comma, for the same `text-shadow` property.

The first is white and is offset to the left and upwards from the text. The second is offset one pixel to the right and down from the text, and is a dark grey. Both the text and its background are the same colour.

```
p.embossed {
        background:#ccc ;
        color:#ccc;
        text-shadow: -1px -1px white, 1px 1px #333;
}
```

Here's the embossed text effect using the CSS code above:

This sure looks nice, but can you spot a problem? What happens if a browser doesn't support shadows (which as we'll soon see means all versions of Internet Explorer before version 10)? Well, the text and the background being the same colour, it's going to be impossible to actually see the text. This demonstrates why we need to be mindful of what happens when shadows aren't supported. Enticing as it is, use this effect with care. We'll take a quick look at what you can do about the lack of support for a CSS feature at the end of the article.

* **Blurred text**. A final illustration of the sort of effects we can achieve is creating a blurred effect.

Here we'll make our text invisible, using the `transparent` keyword value (we could also use RGBA with an alpha channel value of 0, for instance `rgba(0, 0, 0, 0)`). We then create a semi-transparent shadow (using RGBA) that has a reasonable blur of 5px.

Once more, we have to be careful about what happens when a browser doesn't support `text-shadow` . In this case, used as is, text would be invisible in such browsers, including Internet Explorer 9 and older. We therefore use the following code:

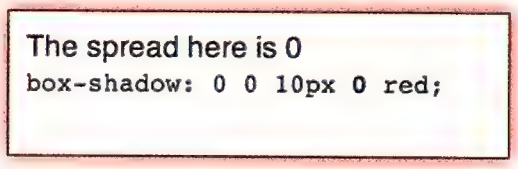
```
p.blurred {
        background: #666;
        color: transparent;
        text-shadow: 0 0 5px rgba(0,0,0,0.5);
        font-size: 3em
}
```

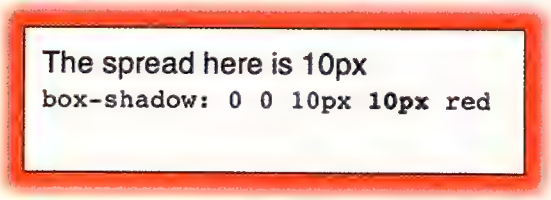
This creates the effect below.

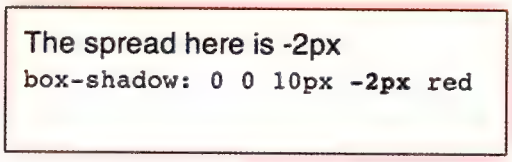
BOX SHADOWS

In addition to adding shadows to text, we can use CSS to apply a shadow to the 'box' of an element. This is outside the border of the element, but inside its margin. As we saw a little earlier, there are some additional features of box shadows over and above what we can do with text shadows.

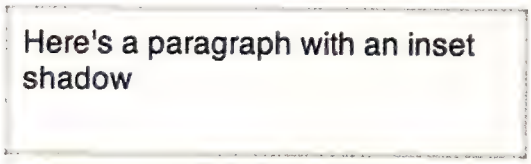
We can spread the shadow, extending it out in each direction from the edge of the element's box, or contracting it inwards from the edge. Below is the same shadow on a paragraph, with only the spread changed. In the first the spread is 0; in the second, we've extended it outwards in each direction by 10px. In the third, we're contracting the shadow inwards by 5px.





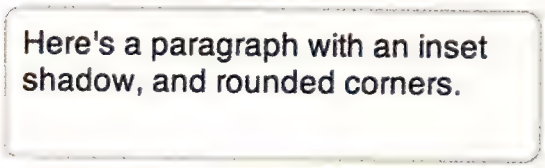


The second difference between text and box shadows is that box shadows can be either inset or outset. Here's the standard shadow above, which by default is outset, but this time we'll add the keyword `inset` : `box-shadow: inset 0 0 6px #111;` .



And not surprisingly, we can add inset and outset shadows on the same element.

You might be wondering how this combines with `border-radius` and the short answer is, as you might expect. The shadow will follow the curve of the element, whether inset or outset. So, here's the above element with a `border-radius` to round its corners:



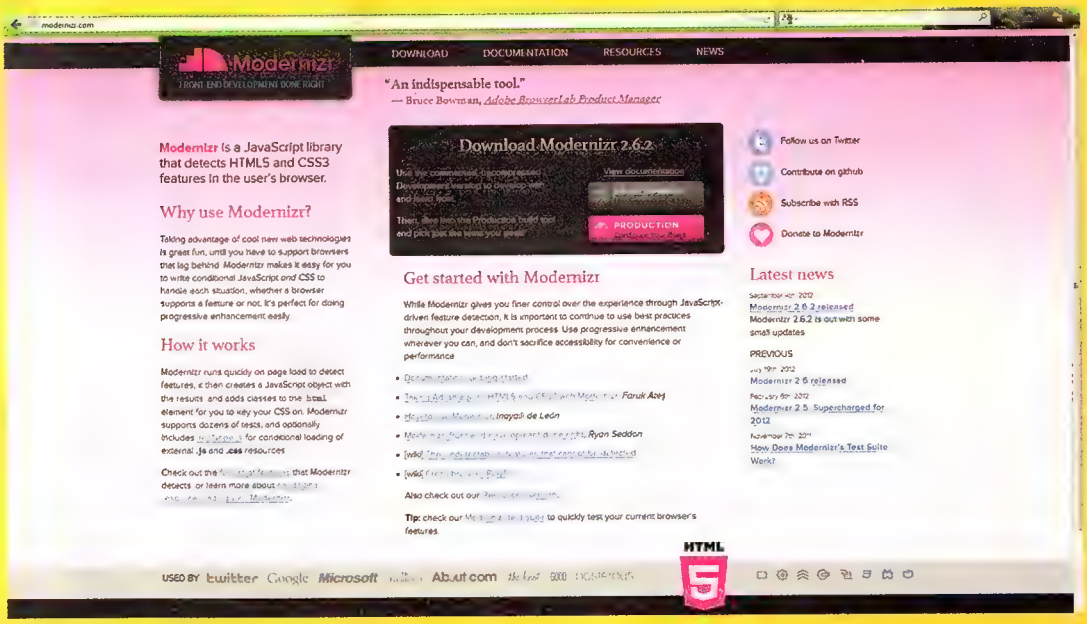
OLDER BROWSERS

I'll let you in on a little secret, whether you're a developer, designer, manager or business owner. Your life will be far less stressful, and more productive if you let go of the outdated belief that web sites need to look the same in every browser. Firstly, because they won't no matter what you do. Secondly, because as the browser landscape fragments, with phones, tablets, game consoles and TVs joining laptops and desktops as commonly used browsing platforms, do we really want our sites to look identical on all of these devices? Used correctly, the features we've covered here can be used today in browsers that support them, but also those that don't — in non-supporting browsers, users will simply have a slightly less polished experience. They'll still be able to access all the content and services your site provides. However, we've seen there are cases with features like `text-shadow`, where we can end up with insufficient contrast between the text and background, making text illegible. To address this issue, we can turn to a nifty tool called Modernizr (**modernizr.com**).

Modernizr is a JavaScript library that can be used simply by adding a single `script` element to your HTML. First, a word about what Modernizr *doesn't* do. Some JavaScript libraries claim to automatically add support for some CSS3 features in browsers that don't support them. Modernizr doesn't do this. What it does do is add class values to the `HTML` element of your document, depending on the support a particular browser has for various CSS (and HTML5) features. For example, if a browser supports `text-shadow`, a class of `textshadow` is added to the html element. How does that help us? Well, now we can use descendent selectors to style elements differently, depending on whether a browser supports `text-shadow`, like so.

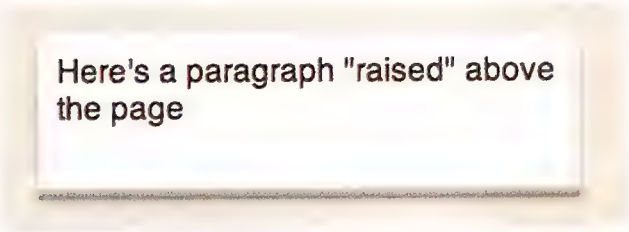
```
.textshadow p.embossed {
        background:#ccc ;
        color:#ccc;
        text-shadow: -1px -1px white, 1px 1px #333;
        font-size: 3em

}
```

In browsers that *don't* support `text-shadow`, the class value textshadow isn't added to the `HTML` element, so the selector `.textshadow p.embossed` won't select paragraphs of class `embossed`.



Modernizr is a JavaScript library that identifies HTML5 and CSS3 features in the user's browser.

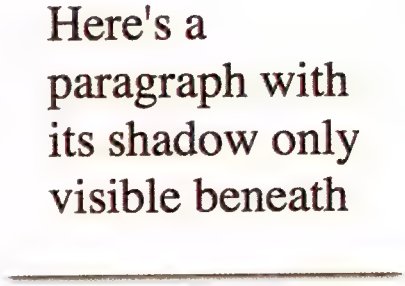
With these building blocks, we can build all kinds of design effects. One you might not even begin to imagine is creating 3D effects with multiple shadows. The example below shows a paragraph 'raised' above the page:



The effect is created by applying increasingly darker unblurred shadows one pixel further down the page from one another, and we finish with quite a blurred shadow. Here's what our CSS will look like:

```
box-shadow:
        rgb(187, 187, 187) 0px 1px 0px 0px,
        rgb(181, 181, 181) 0px 2px 0px 0px,
        rgb(172, 172, 172) 0px 3px 0px 0px,
        rgb(160, 160, 160) 0px 4px 0px 0px,
        rgb(145, 145, 145) 0px 5px 0px 0px,
        rgb(127, 127, 127) 0px 6px 0px 0px,
        rgba(0, 0, 0, 0.2) 0px 7px 1px 0px,
        rgba(0, 0, 0, 0.3) 0px 8px 6px 0px;
```

Another common effect is to have a shadow only on one side of an element. Unlike borders, we can't specify this, although we can adjust the spread of the shadow using the code `box-shadow: 0 8px 6px -6px black;` to achieve this effect, like so:



What we've done is offset the shadow 8px down the page and then contracted it by 6px, so it's only visible for 2px beneath the element.

Hopefully, this goes to show there's much more to shadows than you might initially think. There's quite a bit more in CSS3 to help create delightful effective designs, so next time we'll look at some more of them, including CSS gradients and multi-column text.

TRITTON WARHEAD 7.1 XBOX360 WIRELESS HEADSET

The first true wireless system for Xbox 360.

@ www.hes.net
$ $352

XBOX 360

There's no question that quality audio is one of the more crucial elements in the gaming equation. The question is: how much are you willing to drop for the privilege? Dedicated third-party headsets for the Xbox 360 come in both wired and wireless, but with the latter carrying the caveat of needing wires to get voice chat working over Xbox LIVE. It's simply a fallout from Microsoft being so close-handed with its proprietary wireless technologies. The Warhead changes that and through co-branding, is the first dedicated Xbox 360 headset to offer true wireless audio. Featuring 7.1 audio over 5.8GHz all pumped through 50mm leatherette-clad cans, they're a sheer delight on the ears and easily the best wireless solution out there. It's just a shame they cost almost twice as much as the console itself.

TC

Rocksmith

It's gig time, what T-shirt am I gonna wear?

PC

@ www.rocksmith.com $ US$64.95 via steam

There was only so much pounding the poor old *Guitar Hero* series cash cow could take before we wised up to the fact that it'd been dragged and flogged as far as it could. The scope for plastic, five-buttoned toys is limited, so shifting to real-world instruments is the obvious next evolutionary step. And *Rocksmith* does just that. It takes the core mechanic of rhythm gaming – a series of location-specific 'notes' that scroll along the screen and need to be struck at the correct moment – and applies them to both the guitar and bass. The final package is just as much a series of applied learning tools as it is a video game.

As such, your performance is constantly monitored and the difficulty level of each song is scaled dynamically to suit. Do well and the difficulty builds in intensity and you'll be playing more and more notes within the riffs and phrases. Conversely, perform poorly and it'll drop back down to a more manageable level until you've regained control and composure. It's this dynamic scaling that is both the best and worst aspect of *Rocksmith*. It can tend to believe a little too strongly in your ability, happily throwing new techniques at you before they're really explained.

The soundtrack is rock flavoured, featuring the likes of The Rolling Stones, Nirvana, Muse, Kings of Leon and Queens of the Stone Age with more tracks and artists are available as DLC. While there'll always be technical benefits to professional teaching, we can't help but think this is the future of learning.

Troy Coleman

✔ Expansive package that makes in-depth guitar tuition fun.
✖ My fingers hurt.

10/10

Forza Horizon

Microsoft's sim racer series goes open world.

360

@ www.forzamotorsport.net $ $79.95

With the long rivalry between *Forza* and *Gran Turismo* finally settled (sorry GT – you had a good run), Microsoft has finally seen fit to loosen the reins on its flagship racer, with *Horizon* the first result.

Forza has always straddled the line between sim and arcade racing, but *Horizon* veers off in a new direction, with a focus on street racing in a large open-world environment. Purists need not fear, however: while this game is somewhat akin to the *Need for Speed*s and *DiRT*s of the racing world, it's still a title where you'll need the driving line to stay on the track.

Set in the fictional Horizon racing festival in Colorado, it works the open-world format fairly well. You're free to drive around the entire map from the start, though there's not a lot of point to just aimlessly wandering. The festival's variety of on- and off-road races are slowly unlocked as you progress, and while there's nothing particularly new here, applying the *Forza* driving model to street racing does deliver some decent thrills. There's a dollop of side content, too, but there's not quite enough to stop the world from feeling a little empty.

One of *Horizon*'s most thrilling features is its asynchronous multiplayer system known as Rivals. Here, you're challenged to beat your friends' lap or race times, which often turns into a frustrating yet rewarding game of one-upping each other. And believe us, you'll cheer out loud when you finally best a mate's time by that critical fraction of a second.

Dan Gardiner

✔ Neatly combines *Forza* with open-world street racing.
✖ World a little bare, never quite thrilling.

8/10

Halo 4

Master. Master. Where's the AI I been after?

360

@ www.halowaypoint.com/halo4 $ $88

While Microsoft's in-house development team (343 Industries) has had a finger in the *Halo* pie since its humble beginnings in 2007, Bungie has primarily showered solo in the golden glow of adoration for not only the series' continued success, but in part the success and longevity of the Xbox 360 console itself.

Now that the formal dev team hand-over is complete, the verdict is in; congratulations, you've made another Halo campaign. While its immediate familiarity is somewhat comforting, aside from a few adjustments here and there and a new faction, it does little to distinguish itself on a gameplay level and seems content to languish in mediocrity. It's a far shot from the quirkily fantastic *ODST* or the epic battles and grandeur we saw in *Reach*.

Halo 4 is well crafted and has a focused plot with some visually stunning and staggering super-scaled environments. The story really is great. There's a wonderful sense of hopeless urgency that builds in intensity from the opening scene to the campaign's close. There are also small snippets of great gaming throughout. However, it's a boring, repetitive FPS capped by an hour-long epileptic's delight where both the screen and controller shake uncontrollably.

As well as the obligatory team deathmatch competitive modes, there's a new outlet in the three-player co-operative Spartan Ops missions available to the online fragger looking to do things with their friends. The core mechanics for online play have been tuned to a point where the gameplay feels quicker, more responsive and generally more fun than before. There's also the introduction of XP-based progression and drip-fed rewards and unlockables to keep players coming back for more.

Troy Coleman

✓ Nicely tuned multiplayer mechanics, Spartan Ops, grand environments.

✗ Average gameplay with some poor design choices.

7/10

RESIDENT EVIL 6

Lamenting the good ol' days.

@ www.residentevil.com/6/
$ Consoles $68

360 • PS3 • PC (2013)

Reporting on just how dreadful an experience it is to play RE6 is akin to telling the kids that their favourite goldfish (Jesse) died. The early years for this classic survival horror series were magnificent and have been a staple for many a gamer, in fact RE1 was *the* reason I bought a PS2 console. Sadly, however, the once well-paced, genuinely frightening third-person action has devolved to endless cycles of QTEs, button mashing and stick waggling. There are few snippets of quality gameplay and even hints of classic *Resident Evil* during Leon's campaign, only to be hamstrung by a less-than-perfect shooter and cover mechanics. It's the new benchmark for how out of touch Japanese game development is. But for those still undeterred, RE6 tells a tale of bio-terrorism playable from the perspectives of Chris Redfield, Leon Kennedy, Jake Muller and Ada Wong. Best avoided.

TC

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DEAD OR ALIVE 5

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@ teamninja-studio.com/doa5
$ $68

360 • PS3

My hardcore fascination with fighting games probably started after my third game of *Mortal Kombat* in the local arcade. Learning the requisite stick combinations and button permutations just wasn't my kind of masochism. But there's something compelling about the *Dead or Alive* series that has at least kept my embers of interest somewhat smouldering. It's probably how well it blends all-out fury and a little bit of sexy; the end result could probably be described as titillatingly sadistic. The latest iteration pushes the sexy up a few notches in almost every aspect of play – it's stunning to watch and actually fun to play. There's a deep training mode to help newer players get started and some hefty competition in the online multiplayer once you've chugged through the story content.

TC

Need for Speed: Most Wanted

Consistently dominate your peers.

360

@ www.needforspeed.com/most-wanted $ $98

The *Need for Speed* franchise needs no introduction. There's a mind-blowing 19 titles in a stable spanning almost two decades. That's 20 years of racing, smashing and tearing up the road and getting away from the police. Since the recent introduction of the excellent leaderboard system Autolog in 2010's *Hot Pursuit*, which records and posts race times and speed challenges to in-game leaderboards, it's also given us the chance to demoralise our friends, too. It's this idea of constant peer assessment that blankets developer Criterion's reimagined *Most Wanted*.

After learning the wafer-thin solo story of the top 10 most wanted drivers and the goal of challenging and usurping them, it takes about 90 seconds to understand what's going on. You're simply dropped behind the wheel of a rapidly moving car in an open world and told to win. We wrecked two or three times in the space of that 90 seconds and finished well behind pace against the most unrelentingly intense AI we've faced since *Midnight Club LA*.

Apart from the ever-present Autolog challenges, the best aspect of the game is that it gives players access to customisable high-end street racing, muscle cars and exotics from the start of the game through its 'if you find it, you can drive it' motto. Simply cruise the open world, roll up to a marked parked car and it immediately becomes yours to race away in. Each car has its own series of races associated with it to help progress through the story and hone your skills on the way to the ultra-competitive and insanely addictive online multiplayer.

Troy Coleman

✔ Unrelenting action arcade racing, Autolog.
✖ Some longish load times.

9/10

Skylanders Giants

One part fun game, one part toy commercial.

360

@ www.skylanders.com $ $89.95

Skylanders Giants plays out like the sugar-addled fever dream of the six-year-old inside all of us. The sequel to last year's *Skylanders: Spyro's Adventure* is still a basic stomp-and-thump action platformer with a gentle learning curve, and a whole lot of DLC that's only unlocked by buying *Skylanders* figures, although all the character data for those new players is already on the disc, just as it was with the previous game.

That's quite cynical on Activision's part, especially as one of the unlockable items in-game is essentially advertising for yet more figures. Each figure can be levelled up by playing, and also counts as a life while you're playing, putting yet *more* pressure on parents to buy *more* chunks of overpriced plastic.

Underneath there's a genuinely warm and funny game, with enough character progression to keep you coming back for more. Like the character designs, the plot is largely irrelevant; new 'Giant' *Skylander* figures are back to face an ancient foe, putting their strength to the test, along with their much slower walking speed. The puzzles are simple affairs and combat is more on the glittery side than the genuinely complex.

The end result is a game that's great to play with younger kids because the fail states are few and the jokes are deliberately wide. Original *Skylanders* figures will work with *Giants* alongside the new figures and the level cap jumps up to 15, so even veteran players will find something to do here, even though the action is fundamentally identical to last year's game. *Skylanders Giants* is good fun to play – we just wish it wasn't so expensive to do so!

Alex Kidman

✔ Lots of characters, good to play with the kids.
✖ Lots of figure advertising.

8/10

123 chipchat

SIMON CHESTER

NEWS FROM ALL ACROSS THE WIDE WORLD OF GEEKDOM

IBM CREATES CARBON NANOTUBE CHIP

Microchip advancement is based largely on the miniaturisation of transistors – smaller transistors means you can fit more of them onto a chip and more transistors means more processing power. However, silicon transistors have a limit to how small they can become, so the quest is out for a new material that can replace it.

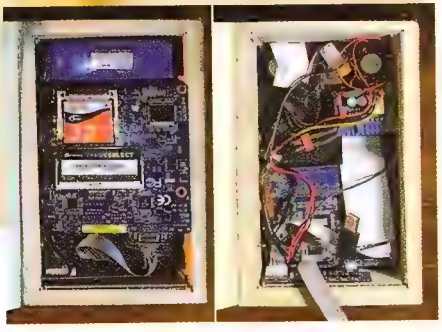
Carbon nanotubes – the new age Wunderstructures that will probably both save and destroy the world – are currently the most likely candidate (ignoring the quantum computing movement), as transistors made from them are absolutely teeny tiny, measuring only tens of atoms across. They are also more electrically conductive than silicon, making it possible for all the megabytes to move faster through the (now literal) tubes.

And, moving one step closer to widespread adoption, IBM recently created a chip made up of 10,000 carbon nanotube resistors – best of all, it actually worked. According to IBM officials, these carbon devices are "poised to replace and outperform silicon technology, allowing further miniaturisation of computing components and leading the way for future microelectronics". They do have a long way to go, with commercially useful chips requiring more than a billion transistors.

REAL *MYST* BOOK IS IMPRESSIVE & EXPENSIVE

As a youngin', I spent hours lost in the game *Myst*. I remember being astonished at the realistic graphics and immersed in the worlds that they represented. As far as gaming nostalgia goes, *Myst* is near the top of my list. This sense of nostalgic fondness clearly doesn't reach as far into my heart as it does into Mike Andio's, who has painstakingly recreated the magic book seen in *Myst* – down to even sourcing a copy of the same issue of *Harper's New Monthly Magazine* 'Vol. LIV, Issue 312, Dec 1876 to May 1877' that Cyan originally scanned as a texture reference.

Inside, Mike has stuffed a tiny XP PC, capable of playing every single *Myst* game via the 5in touchscreen. I can't help but think that he may just have been better off stuffing an iPod Touch in there, though. Interested? He's willing to part with it for the bargain price of US$15,625.



IROCK HELPS GRANDMOTHERS & HILLBILLIES CHARGE iDEVICES

There are some pleasures in life that have been enjoyed by generations. One is a warm summer night spent out on the porch with your iPad. I have vivid memories of sitting on my grandmother's lap (rest her soul), in her rocking chair, while she read me a bedtime story from her old iPad. Oh, how I cheaped at how cranky she became when the extension cable charging the iPad got caught under the rockers of her chair and we'd shudder to a stop. Great days. Your cranky grandmother's mood can now be noticeably lightened by the iRock – a rocking chair with an insert iPad stand that actually charges the device via your rocking motion. It even has stereo speakers built in the headrest. It sells for £1,300 and will hopefully ship by late 2013. apc

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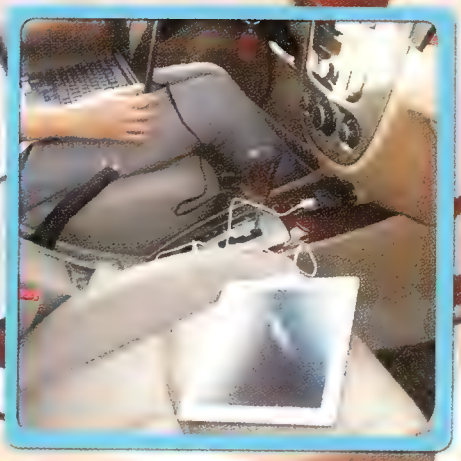

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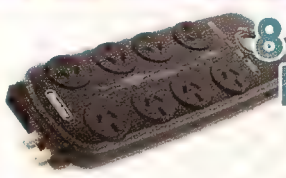

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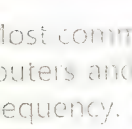

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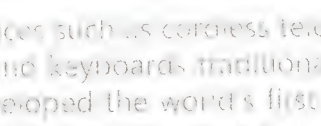

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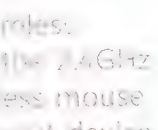

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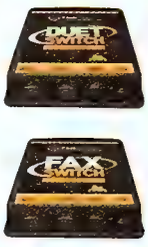

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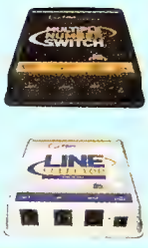

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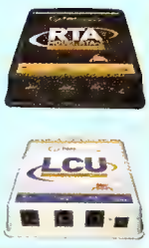

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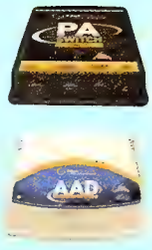

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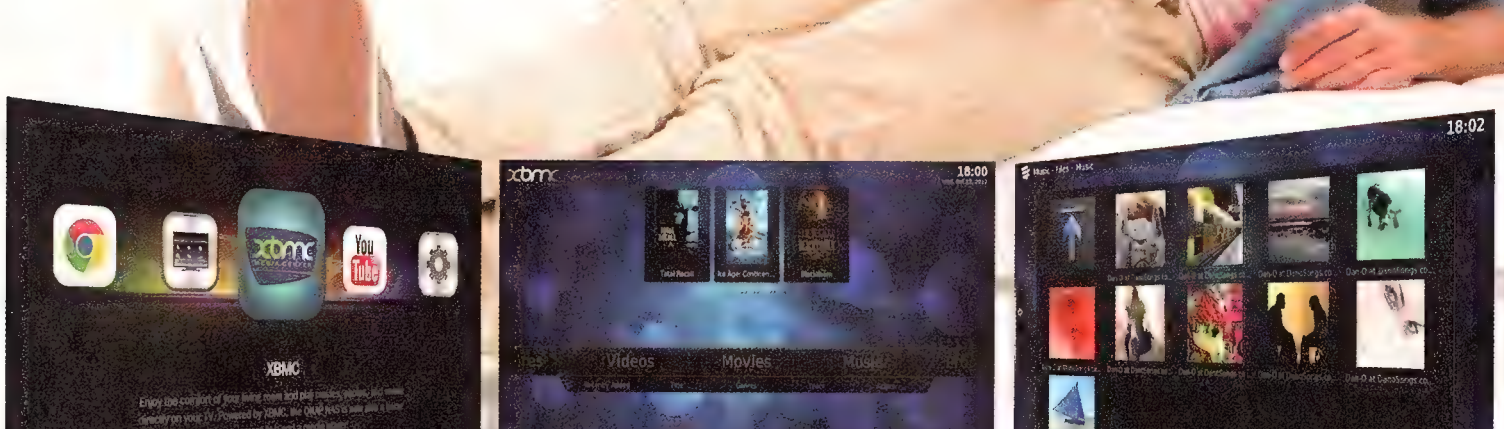

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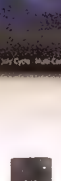

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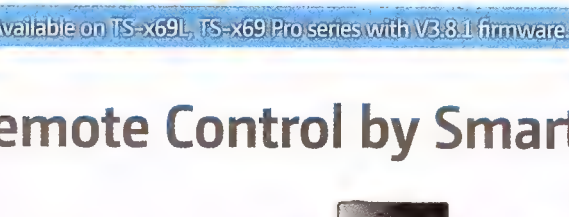

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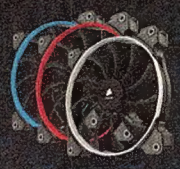

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